INTRODUCTION TO PSYCHOLOGY.

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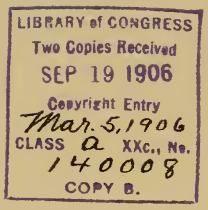

PREFACE.

These studies in psychology are intended primarily for use in the author's own classes. As the title implies they are merely introductory to psychology. Every teacher of psychology has doubtless felt the need of work in his classes of which the definition of terms constitutes a large part. Such work is necessary preparation for intensive psychological study further on. It is the intention to supply this need in the author's own classes, that prompts to the present little volume.

A second thought is to give students a general idea of the organization of psychology, and a comprehension of its organizing principle to the end that an intensive study of any particular aspect of the subject may be seen in its proper relation to the science as a whole.

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CHAPTER I.

THE NATURE, SUBJECT-MATTER AND METHOD OF PSYCHOLOGY.

The Meaning of Science.—Every one who has lived very long among people has some knowledge of the human mind. This knowledge he has picked up here and there by experience. An examination of this knowledge will show that it is in bits, scraps, and fragments; that it consists of truth mixed with error; that is, it is not very accurate; and that it is not very extensive, and so not complete. Such knowledge, unsystematic, inaccurate, and incomplete is called *common,* or *ordinary,* knowledge. Common knowledge may be transformed by experiment, observation, and thinking into knowledge which is *systematic, accurate* and *complete;* that is, into *scientific* knowledge, or *science.* Thus the following statement may be made for science:

Science is knowledge which results from making systematic, accurate, and complete common knowledge. It is to be noticed that science is a product of the human mind. It is a mistake to think that, for instance, botany as a science has existed as long as the truths of plant life. Botany has existed only since humanity has learned the truths of plant life, has made them into a system, accurate, and complete. Thus the truths of plant life are many, many years older than botany.

The Presupposition of Science.—Science is based upon the presupposition that *the human mind acts uniformly;* that is, that under the same conditions, one person's mind acts in general as other persons' minds act; also, that one person's mind acts at one time in general as it acts at other times under the same conditions.

Illustration.—When ten persons look at snow it appears white to each one; also, if one person looks at snow at ten different times, it looks white to him each time. That is to say, the mind acts uniformly, and only this enables it to establish the scientific truth that snow is white. If to one it appeared white; to a second, green; to a third, yellow, and so on, or to one at one time, white; a second time, green; a third time, yellow, and so on, the truth could never be established. And this because the mind did not act uniformly.

Mental Phenomena.—If one will turn his attention inward and notice what his own mind does, one of the first things which he will discover is that it changes. Now he finds his mind thinking, for instance, about grammar and at another time he finds his mind thinking about history. The only way he can account for *his mind's being in different conditions at different times* is that it changes. This, one knows, if he knows anything. There is nothing of which one can be more certain than that his mind changes. These changes of the mind psychologists call *mental phenomena.* A change is a phenomenon, and a mental change is a mental phenomenon. Other terms which have the same

meaning are *activity* and *experience*. From the above the following statement may be made:

A mental phenomenon is a mental change, or activity, of any kind.

Physical Phenomena.—Any physical thing is a thing which occupies space, such as wood, a book, a horse, or one's body. If one observes physical things about his first discovery is, that they change. This he knows as well as he can know anything except that his mind changes. That his mind changes he knows most surely of all things.

The thing that enables one to know that physical things change is that they are found to be in different conditions and positions at different times, and the only explanation for this is that they have changed.

The human body occupies space, and since it is seen to be in different conditions and different positions at different times, it is known to change. These changes of the body are physical phenomena.

An important truth about mental phenomena is that all mental phenomena are accompanied by physical phenomena. Sometimes the physical phenomena seem to precede the mental, and sometimes the mental seem to precede the physical, and sometimes they seem to be simultaneous. But in any case, so far as we know, there is never a mental phenomenon unless there is in some way connected with it a physical phenomenon. They are said to correspond; that is, there are *corresponding* mental and physical phenomena.

Now, no one knows ultimately what the mind is, nor can any one study the mind directly. But no one

knows ultimately what a tree is; no one knows what light or electricity is. We do know, though, how they act or change; that is, we know their phenomena, and such knowledge is very valuable to us. So we need not be discouraged that we can not know or study the mind directly, for we can know and study its phenomena and that is as much as we can study and know about anything. Now the science which deals with the phenomena of the mind and the corresponding phenomena of some part or parts of the body is psychology.

Every science deals with laws; that is, truths which are true of a large number of cases. Thus, psychology deals with the laws of mental and corresponding physical phenomena, truths that are true of the phenomena of all normal minds. From the above study the following definition of psychology is reached:

Psychology is the science which treats of the laws of mental phenomena together with their corresponding physical phenomena.

The word, psychology, is derived from the two Greek words, *psyche,* meaning *mind* or *soul* and *logos,* meaning *thought* or *knowledge.*. Thus literally psychology means *knowledge of soul or mind.*

The terms *mind, soul,* and *spirit* are used interchangeably by psychologists. Theology makes some distinctions in the meanings of these terms, but such distinctions are not observed in psychology.

Subject-matter of Psychology.—In the mastery of any subject various points of truth must be studied and learned. These truths are usually called facts. Also in mastering the subject the connection among the facts or

truths of the subject must be learned. Thus in mastering a subject the *facts* and their *relations* must be learned. These facts and relations in any subject constitute its subject-matter. The following are formal statements for subject-matter:

A subject-matter of any subject is the facts and relations to be learned in any subject.

A subject-matter is the material of study in any subject.

In the subject-matter of psychology are to be found two points in general, as follows:

1. Mental phenomena.
2. Corresponding physical phenomena.

In physiology physical phenomena are studied, too. But physiology is not psychology. Not so many physical phenomena are studied in psychology as are studied in physiology. For instance, circulation, respiration, and digestion are studied carefully in physiology, but are hardly studied at all in psychology.

And again the physical phenomena are studied in psychology in different connections, or relations, from what they are studied in physiology. In psychology they are always studied in connection with the mental phenomena, in so far as they affect and in turn are affected by mental phenomena.

The Method of Psychology.—The question for study in this connection is *In what manner may the mind study psychology*? That is to say, How may the mind get at, classify, and explain the facts of psychology?

In general the four following methods of studying psychology may be seen:

1. The Introspective method.
2. The Experimental method.
3. The Comparative method.
4. The Objective method.

Introspective Method.—The introspective method is the process of studying psychology by means of introspection. But what is introspection? It comes from *intro* meaning *within* and *spicere,* meaning *to look.* The *ion* in the word signifies *the act of.* Thus introspection is the act of looking within.

We learn the physical phenomena in the world around us with our senses; with sight, hearing, touch, taste, etc. Thus we learn the moving of objects, lightning, thunder, the fragrance of the rose, and the aroma of fruit. But we cannot learn the phenomena of the mind in this way. These must be learned by the mind's looking into itself. We can turn our minds in upon themselves and let them learn their own phenomena. Thus we can study our wishes, our hopes, our motives, our thoughts, and our feelings. The process of thus looking within with the mind's eye is introspection. The following is a formal statement for it:

Introspection is the process of making one's own mental phenomena objects of study to find out what they are.

Introspection is also called *internal perception.*

Difficulty of Introspection.—There are two aspects to the difficulty of introspection.

1. It is hard for those who have been used to studying objects learned through the senses to turn their

minds in upon intangible, spiritual things and study them.

2. If one turns his mind in upon a thought or feeling to study it, it at once disappears and he has only the memory of it to study.

The things in our minds which we know through introspection are objects just as truly as the things we touch, taste, see, etc. But so accustomed do we become to thinking of only the things which we can know through senses as objects that it is difficult at first for us to see that mental phenomena are also objects. Thus since it is difficult to think of mental phenomena at all, it is of course much more difficult to observe, explain, and classify them *accurately*.

It is one thing to have the feeling of love or anger but an entirely different thing to study it. Just as soon as the mind is turned inward to study the love or anger, it disappears and only the memory of it remains to be examined.

But even if the introspective method does have its two difficulties, it is entirely necessary to the study of psychology. Without introspection no one could ever be made to understand mental phenomena. No one can understand anger except he himself has been angry, and he can study his own anger only through the introspective method.

Psychology must then be studied by the introspective method.

The Experimental Method.—We can experiment with plants directly in the study of botany; with animals directly in the study of zoology, or with matter

directly in the study of physics, but not with mental phenomena directly in studying psychology. Yet there is such a thing as the experimental method in studying psychology. We can experiment with the mind indirectly through its connection with the body. The connections of the mind with the body; that is, its connection with eyes, ears, nerves, muscles, etc., can be experimented with, and thus mental phenomena changed and studied.

The study of mental phenomena in connection with the body gives rise to what is called *physiological psychology;* that is, the study of physiology in connection with mental phenomena not for the purpose of better understanding the physiology, but for the purpose of better understanding the psychology.

The study of mental phenomena wholly through introspection gives rise to *introspective psychology;* that is, psychology so far as it can be learned through introspection.

Comparative Method.—Psychology deals essentially with the phenomena of the *normal* mind. But help comes to the student of psychology from comparing the phenomena of the normal mind with phenomena of other minds. Thus the phenomena of the normal adult mind may be compared with the phenomena of the minds of the following:

1. Lower animals.
2. Children in various stages of development.
3. Persons with defective or disordered minds.

The study of psychology through such comparing is by the *comparative method,* and gives rise to what is called *comparative psychology.*

The Objective Method.—The mind acts and produces results which are objective. The student can study these objective results of the mind and thus learn much about it in a similar way to his learning much about electricity by studying the results it produces. These objective results are fixed, certain and definite signs to us of the way the mind works. Some of these results are:

1. Language and science.
2. Institutions of civilization.
3. Artistic creations.
4. Philosophy and religion.

Studying mental phenomena by means of these objective manifestations is by the *objective method.*

Necessity of Introspection.—It matters not by what method we study mental phenomena we are able to understand them only by referring them to our own mental experiences and this we can do only by introspection. Thus the student of psychology can make no progress at all in its study without introspection. No one who had never had a sensation could be made to understand what a sensation is. The man who had always been blind thought scarlet must resemble the sound of a trumpet.

Thus the introspective method in psychology is the most fundamental method, and introspective psychology is the most fundamental kind of psychology.

The Nature of the Mind.—The question always asked the psychological student either by himself or by some one else and never very satisfactorily answered is *What is the mind?* This question is no more unanswer-

able than the questions, What is electricity? or What is matter?

Every student soon learns that the most persistent thing in the world in which he lives is *force;* that is, that which does work. Force does all the work done in the world of any kind whatever. Force working in various forms which we can in any way know we call various things. Thus force manifests itself in one way and we call it electricity; in another way and we call it heat; in another way and we call it gravitation; in another way and we call it a horse; in another way and we call it an oak tree; in another way and we call it a star; in another way and we call it the *mind.* But the form in which the force which we call the mind manifests itself is in consciousness. Thus the following definition of the mind is reached:

The mind is that form of force which manifests itself in the phenomena of consciousness.

It is not supposed that this definition will be fully comprehended by the student who is a beginner in psychology, but it is believed that further study will clarify and elaborate it to such an extent that it will prove very helpful.

CHAPTER II.

THE UNITS OF INVESTIGATION.

Meaning of Unit of Investigation.—The subject of psychology is a science, and has resulted from the fact that the human mind is dissatisfied with common, or ordinary, knowledge and abhors vagueness. In its effort to change ordinary knowledge to science it begins by stripping away from the subject of study all irrelevant, accidental, and occasional facts, seeking the simple, elementary, and persistent. It is this simplest, most elementary, and persistent form of the subject-matter which is the *unit of investigation.* The formal statement for it is as follows:

The unit of investigation in any science is the simplest, most elementary, and persistent form of its subject-matter. That is to say, it is the simplest, most elementary, and persistent whole thing which can be studied in a science.

Each science has its unit of investigation. The chemist knows that his science is concerned with the element; namely, *oxygen, hydrogen, carbon, calcium, sodium, chlorine, nitrogen,* etc. He studies their number, qualities, atomic weights, combinations and products. Thus the element is the unit of investigation in chemistry.

The botanists have found that their unit of investigation is the *organic vegetable cell.* The zoologists have found that their unit of investigation is the *organic animal cell.* They study its structure, development, combinations and products.

The science of psychology differs somewhat from other sciences with regard to its unit of investigation. Other sciences have but one unit, psychology has two. This is because of the two distinct divisions in the subject-matter of psychology: first, the *mental phenomena,* and secondly, the *corresponding physical phenomena.* The unit of investigation in the study of the physical phenomena is the *nerve cell.* The unit of investigation in the study of the mental phenomena is the *sensation.*

How It May Be Studied.—How does the psychologist study the unit of investigation in psychology?

His first task is to observe it in order to find out what it is; that is, its nature so that he may be able to think about it in some definite way.

His second task is to find out how it behaves itself; how it acts; what its processes are under various conditions.

His third task is to find out what new products or combinations are brought into being as a result of the activities or processes of the unit of investigation.

The psychologist's fourth task is to discover, formulate, state and learn the laws and principles of both the mental phenomena and the corresponding physical phenomena.

The Nerve Cell.—The nerve cell is a small body of neucleated nervous matter with thread-like extensions

reaching from it. Both the central body and the thread-like extensions make up the nerve cell. The extensions are of the same kind of material as the central body and are continuous with it. It has been sometimes stated that just the central body is the nerve cell. And that the extensions from it are not portions of the cell. But this is wrong. It takes both the central body and all the extensions to make the nerve cell. Nerve cells thus consisting of the central body and the extensions are called *neurones* by neurologists.

Form of Neurones.—Neurones are of various forms. The central body may be *spherical, cylindrical, pyramidal or irregular.* All are however more or less irregular and all developed cells have the thread-like extensions. There are mere germ cells which have no extensions. They are, so to speak, undeveloped baby cells. They are called *neuroblasts.*

Material of Nerve Cells.—Nerve cells are composed of a granular, viscid substance usually called *protoplasm.* Protoplasm is a living substance. Vitality is one of its necessary characteristics. There is no such thing as dead protoplasm. Its exact chemical composition is unknown, though it is known to be very complex. Its main characteristics are absorption, secretion and excretion.

Nerve Fibers.—Nerve fibers are parts of nerve cells, the extensions, or prolongations, leading off from the central body. They are too small to be seen with the naked eye, but vary much in both diameter and length. Some are as large as one twelve hundredth of an inch in diameter, and some are no larger than one one

hundred thousandth of an inch in diameter. They vary in size between these two extremes. They have a branching structure and vary in length from a part of an inch to several feet in length.

There are in general two kinds of nerve fibers: those which carry impulses toward nerve centers, and those which carry impulses from nerve centers. Those of the first kind are called *afferent* nerve fibers and those of the second kind, *efferent* nerve fibers. The derivation of these words helps in remembering their meaning. Afferent is from *ad,* meaning *to* and *ferre, to carry.* Thus afferent nerve fibers are *carrying to* nerve fibers. Efferent is from *ex,* meaning *from* and *ferre, to carry.* Thus efferent nerve fibers are *carrying from* nerve fibers.

Sensory and *motor* are terms which mean nearly the same as afferent and efferent when applied to nerve fibers, but not quite the same. Sensory and motor are not quite as broad terms as afferent and efferent. Nerve fibers that carry impulses to nerve centers which do not result in consciousness are afferent nerve fibers, but not sensory. Such are the afferent nerve fibers carrying impulses from the iris of the eye to their nerve centers. And nerve fibers carrying impulses from their nerve centers which do not result in muscular action are efferent nerve fibers, but not motor. Such are the fibers carrying impulses from their centers to the liver, resulting in the secretion of the bile.

The function of the nerve fibers is *to unify the action of the nervous system.* This they do by carrying impulses from one nerve center to another. Thus by

means of the nerve fibers the touch corpuscles in one's toes are in communication with the nerve centers in the highest part of one's brain.

Number of Nerve Cells.—The number of nerve cells in the human body is so great that one can form no adequate idea of them. It is estimated that there are more than three thousand million in the brain alone. At any rate it is certain that every one has a good many million which remain unused and so never develop.

It is well known that cells increase in number by cell division. Nerve cells increase in number in this way early in the life of the human being. But this increase in the number of nerve cells in the human being ceases before birth. There is no increase in the number of nerve cells in the human body after birth. Not one of us has a nerve cell more than we had when we were born. Some of us may have fewer, but none has more.

Connections Among Nerve Cells.—Contrary to popular belief, no two nerve cells in the human body have a continuous nervous connection. Each nerve cell is a distinct and separate thing. There is no extension from any nerve cell which is continuous with the extension from any other nerve cell. Thus there is not a connection of *continuity* between nerve cells.

How then are nerve cells connected? Very much in the same way that the branches of two trees growing side by side are connected. Or in the same way that the roots of two trees growing side by side are connected. This connection is a connection of contact. Thus nerve cells have contact connections but do not have connections of *continuity*.

It has previously been seen that developed nerve cells consist partly of extensions or prolongations from the central body.

"These are of two kinds, (1) the *axone,* a fiber having the quality of conductivity and becoming what we have called the axis cylinder of a simple nerve, or nerve fiber; (2) the *dendrons,* which divide into finer branches or rootlets, called *dendrites.* Their functions are somewhat uncertain, including possibly that of nutrition in the service of the cell body, but probably that of conductivity also.

"*Axones.*—The axones have a branching structure and vary greatly in length, from a fraction of an inch up to two or three feet, according to location and use. They often branch greatly, throwing off side branches called laterals, which branch again in turn. They usually terminate in little tufts resembling the fingers of a hand, or the rootlets of a plant, and known as the arborization of the axone. The arborization of one axone may, in appearance, clasp or encompass the cell body of another neurone, or the arborization of one axone may, interlace with the dendrites of another, and thus effect communication with it by a process thought to be similar to that of electrical induction. The arborized connections between neurones are numerous in the spinal cord and medulla, and seem to obviate the necessity for axones of greater length, while furnishing a greater diversity of paths between various parts of the brain and the outlying members of the body. Neurones are anatomically separate, do not penetrate one another, but

communicate force something like a row of men clasping hands with one another."

The Sensation.—When the end of any sensory nerve fiber is stimulated, it arouses a disturbance there; this disturbance extends along the nerve fibers until it reaches the brain and causes a disturbance there which in some way arouses a state of consciousness, if the disturbance is great enough. This state of consciousness is what psychologists call the *sensation.* The awareness of cold, warmth, pressure, color, noise are states of consciousness which are sensations.

Steps Leading to.—The steps leading to the sensation are partly mental and partly physical, and are as follows:

1. External stimulus.
2. Excitation of outer nerve ending.
3. Transmission of impulse.
4. Disturbance in brain.
5. Corresponding disturbance in mind.
6. The resulting state of consciousness—*the sensation.*

Illustration. If one should put his hand on a hot stove, the motion in the particles of the stove—the stimulus—would cause a disturbance in the touch corpuscles in his hand which would extend along the nerve fibers and arouse a disturbance in the brain. Then there would be a corresponding disturbance in the mind from which would result the pain, the state of consciousness—*the sensation.*

Or again, if a gun were fired the motion in the air would disturb the ends of the nerve fibers in the ears,

which disturbance would extend along the nerve fibers and disturb the brain. Then there would be a corresponding disturbance in the mind from which would result the sound, the state of consciousness—*the sensation.*

External Stimulus.—In the two illustrations above the thing which disturbs the outer end of the nerve fibers is motion. In the first instance it is motion in the particles of the stove and in the second it is motion in air. A careful analysis of various kinds of stimulus will reveal the truth that it is always motion in some form.

"But numerous as seem the various ways in which external bodies may affect us it is found that these various modes are reducible to one—*motion.* Whether a body is near or far, the only way in which it affects the organism so as to occasion sensation is through motion. The motion may be of the whole mass, as when something hits us; it may be in the inner particles of the thing, as when we taste or smell it; it may be a movement originated by the body and propagated to us through the vibrations of a medium, as when we hear or see. But some form of motion there must be. An absolutely motionless body would not give rise to any affection of the body such as ultimately results in sensation."

But there may be much motion in the world about us that is not stimulus to us. That motion may be stimulus it must come in contact with some part of the nervous system. Thus the following statement for stimulus is reached:

Stimulus is any form of motion which comes in contact with the nervous system.

While stimulus is most frequently external to the body, it is not necessarily so. But it is always external to *the mind.*

Excitation of Outer Nerve Ending.—Most of the sensory nerves have specialized outer, or peripheral, endings. The retina of the eye; the touch corpuscles, the taste buds, etc. are the specialized ends of nerve fibers. Motion coming in contact with these arouses them to a state of motion, disturbance, or vibration. It is this disturbance which is called *the excitation of the peripheral nerve ending.*

This disturbance gives the impulse a strong initiative and sends it forward with greater strength than it would otherwise have.

Transmission of Impulse.—The disturbance in the peripheral nerve ending extends along the nerve fiber to the nerve center, the brain, and this is called *the transmission of the impulse.*

But what is the thing which is called an impulse? It is *an excess of energy,* or *a surplus of force.* A surplus of force always produces motion. Thus the impulse produces motion. The nerve fiber may be thought of as made up of very small particles in contact with each other. Stimulus disturbs the end particles which disturb those in contact with them, those disturbing the next, and so on. The motion of each particle is produced by the excess of energy transferred to it by motion. In a similar way a nerve center may possess an excess of energy, or force, and motion results. All motion in the world is the result of impulse, or of an excess of force,

or energy. The ultimate source of all impulses in so far as our material universe is concerned is the *sun.*

Rate of Transmission.—It used to be thought that the impulse was an electrical current passing along the nerve fiber as if it were a wire. But now, since the rate of the nervous impulse has been measured, it is known to be much too slow. The nervous impulse travels about 110 feet per second, while an electric current travels about 186,000 miles per second. One hundred and ten feet per second is the approximate rate of nervous transmission of impulse. Conditions sometimes change this a few feet one way or the other. One hundred and ten feet per second is seventy-five miles per hour. So nervous impulse travels as fast as a train with a speed of seventy-five miles per hour.

"A sensory nerve conducts a message at the average rate of 111 feet per second. If a man had an arm 111 feet long, one second would elapse from the time his finger was pricked before he felt the pain."

"If a man had an arm sufficiently long to plunge into the sun's vaporous metal, 140 years would roll by before he felt any pain. In other words he would die before he knew that the hand was burned. A motor nerve also transmits a command from the brain to the muscle at the rate of 111 feet a second. Suppose an orange tree ninety-three millions of miles in height; and the hand on an arm of that length already lying on a bough one foot from a desired orange. The mind issues a command to grasp the fruit. This order would reach the hand in 140 years, and not until then would the hand grasp the fruit."

Disturbance in Brain.—The impulse reaches the brain and arouses a disturbance there. The disturbance may be small or it may be great, depending upon the degree of nervous tension at the time, and the force of the stimulus. Sometimes it is almost like dropping a spark into a box of tinder or a quantity of gun powder.

Corresponding Mental Disturbance.—Just how the disturbance in the brain occasions a mental disturbance no one knows. But that such a mental disturbance occurs we do know. Introspection tells us this, and we also infer it from the observation of others. I know that a loud noise or bright light has in close connection with it a mental disturbance. And I know this as well as I can know anything on earth. Psychologists say that the connection between the brain disturbance and the corresponding mental disturbance is unaccountable, unthinkable, and incomprehensible.

The State of Consciousness—the Sensation.—The sensation itself is a purely mental thing, not part mental and part physical, and not physical but always wholly mental. It is consciousness resulting from the mental disturbance corresponding to the disturbance in the brain. It is the state of consciousness resulting from a mental activity. It is a condition of the mind. It is fundamental in mental life. A pain from pricking your finger is a sensation. The odor from smelling a rose is a sensation. The flavor from fruit, the aroma from coffee are sensations.

"Sensations are *in the mind* and not in various parts of the body. One says that he has a pain in his toe, and so it surely seems to the unsophisticated person;

but that is purely a matter of association. The nerve ends are in the toe, but the pain is in the mind only.

We must carefully refrain from speaking of sensations as traveling or being 'carried' from the periphery to the brain. Sensations can not travel. Nerve currents pass from the periphery to center, but sensations, never. We need, therefore, to distinguish between sensations, which are psychical, and nerve-impressions, which are physical. They may be thought of as having their point of contact in the cerebrum."

Definition of Sensation.—The following definition of the sensation results from the previous study:

The sensation is a state of consciousness resulting from a mental disturbance corresponding to a brain disturbance caused by some external stimulus.

Importance of Sensation.—The sensation is the most fundamental mental fact. It is the starting point in all mental development. Without the sensation the mind could never start in getting knowledge. Without it there could be no feeling, and without it the development of the will could never begin. It is the first conscious step across from the physical to the mental.

"Sensation is the meeting-place, the point of coincidence of self and nature. It is in the sensation that nature touches the soul in such a way that it becomes itself psychical, and the soul touches nature so as to become itself natural. A sensation is, indeed, the transition of the physical into the psychical."

CHAPTER III.

THE NERVOUS SYSTEM.

Composition of.—The nervous system is an aggregation of nerve cells. As previously seen these cells are anatomically independent. They are connected by contact, though, so that they may work in unity. This fact that they work in unity, organize their work, is all that enables us correctly to call it the nervous *system.*

Centers and Ganglia.—The body of the nerve cell from which the fibers are prolongations is a nerve center. Several or many of these bodies forming masses in contact or apparently so are nerve centers. Thus there are centers in the spinal cord and the brain is a great nerve center.

Knots or masses of nervous matter are called nervous ganglia. Thus again the brain is a great nervous ganglion.

Functions.—The functions of the nervous system are in general three, as follows:

1. To transmit impulses.
2. To control impulses.
3. To serve as a store house of energy.

Transmission of Impulses.—The human body is called upon in life to unify the action of its various parts. In doing this these parts must communicate one

with another. This communication is carried on by the transmission of impulses. And it is an important part of the work of the nervous system to transmit these impulses.

Controlling Impulses.—Impulses do all the work of the body and mind, too. But of themselves they are purely mechanical and uncontrolled. They, unless controlled, produce motion merely along the lines of least resistance. But in all reflex action the nervous system has the impulses to act so as to do some kind of necessary work; that is, it controls the impulses. The nervous system also helps to control the impulses in other kinds of activity than reflex, in any sort of activity in the body or mind whatever.

Store-house of Energy.—A great amount of energy is stored up in the nervous system. It is kept in the nerve centers until occasion calls for its discharge. The muscles are powerless to do work without the discharge of energy to them along some nerve fiber. The more energy there is stored up in the nerve centers the greater the nervous tension is, and the more impulses there are. Without the storing up of the energy in excess in the nervous system there would be no such thing as self-activity of either the body or the mind.

Divisions of the Nervous System.—For the purpose of helping ourselves in study, the nervous system may be thought of in two divisions:

1. The central nervous system.
2. The peripheral nervous system.

The Peripheral Nervous System.—The peripheral nervous system consists of all nerve cells, nerves,

nerve fibers and nervous ganglia lying outside and around, to some extent, the spinal cord and brain. The nervous mechanism of the eye, of the ear, of the nose, of the mouth, of the skin, and of heart, lungs, and digestive organs helps constitute the peripheral nervous system. The term,*peripheral,* is from two Greek words meaning *carried around.* Thus the peripheral nervous system is carried around the central system.

The Central Nervous System.—The central nervous system consists of the brain and spinal cord. In the development of the nervous system there is a time when it consists wholly of the spinal cord, and the spinal cord is simply a tube. From this tube of nervous material all the rest of the nervous system is developed, the peripheral system and the brain.

The Spinal Cord.—The spinal cord is a column of soft nervous matter extending from the brain downward in the cavity formed by the bones in the spinal column for about 18 inches in man, where it tapers off into a filament. The diameter of the spinal cord varies at different lengths but averages on the whole about one half an inch, or more exactly about as large as one's little finger near the middle. Running the length of the spinal cord in front is a deep furrow called the *anterior fissure,* and along the back of the cord is another deep cleft called the *posterior fissure.* The anterior fissure is wider than the posterior fissure, but not quite so deep. The two fissures extend into the cord so far that they almost meet, and thus nearly cut the cord into right and left halves.

Material of the Cord.—If the spinal cord be cut

across and one looks at the exposed cross section, a grayish appearing substance lying on the inside will be seen surrounded by a whitish looking substance. In each half the gray matter is somewhat in the form of a crescent with rounded horns, the convex side of the crescent being toward the center and the horns pointing to the front and the back. The white matter of the cord is made up of nerve fibers almost wholly, and the gray matter is made up mainly of nerve cells, but there are some fibers intermingled with them.

The Spinal Nerves.—From the spinal cord are given off nerves in pairs at intervals along its length. These nerves are called the *spinal nerves,* and there are 31 pairs of them. The nerves of each pair spring from the same level, one from the right half and one from the left half of the cord. Each nerve springs from two roots, one from the anterior side and the other from the posterior side of its half. The anterior and posterior roots unite to form one nerve, and then pass from the spinal cavity through openings between the bones of the spinal column. Afferent nerve fibers form the posterior roots and efferent fibers form the anterior roots but both are bound up in one nerve. These fibers are distributed to the muscles and skin of the trunk.

Functions of the Spinal Cord.—The spinal cord has two functions, as follows:

1. The nerve fibers in the cord form the connection between the brain and peripheral nervous system. Thus sensory impulses are sent to the brain from the sense organs, and motor impulses are sent from the brain to the muscles, and this is its first function.

2. There are nerve centers in the spinal cord which control impulses without imposing the task on the brain and mind, and this is its second function.

The Brain.—For our purposes here all that part of the central nervous system contained in the cranial cavity will be considered the brain. It is the largest nerve center in the body.

Divisions.—In a general way the divisions of the brain are three in number:

1. The medulla oblongata.
2. The cerebellum.
3. The cerebrum.

In addition to these three the Pons Varolii may be considered a fourth division, but from a psychology point of view of minor importance.

The Medulla Oblongata.—The medulla oblongata is continuous with the spinal cord and projects upward in the cranial cavity from it. It is located somewhat below and almost in front of the cerebellum and nearly centrally below the cerebrum. In structure it is complex, composed of both white and gray matter arranged much as in the spinal cord, but the proportion of gray matter in it is greater than in the cord.

The medulla has at any rate three important functions, as follows:

1. It forms a pathway for all impulses to the hemispheres of the cerebrum from the spinal cord and from the hemispheres of the cerebrum to the spinal cord.
2. It gives rise to six pairs of the most important nerves in the human body.
3. It contains the nerve centers which control

respiration, the beating of the heart, the size of small arteries, swallowing, the secretion of the saliva, and some other processes.

The Cerebellum.—The cerebellum lies directly behind the medulla and slightly above it and directly below the rear portion of the cerebrum. It consists of two masses much larger than the medulla. Its surface is closely folded into small ridges. It is made up of both white and gray matter.

Functions.—The cerebellum seems to have for its main function the control of the muscles in certain kinds of reflex action. When one is learning to walk or skate or ride a bicycle he must direct his actions with his mind, but there comes a time, if he keeps practicing, when he no longer has to direct these actions with his mind. The actions then have become reflex. But they were not at first reflex. Such reflex actions are called *acquired reflexes.* Now the cerebellum is believed to contain the nerve centers for the acquired reflexes employed in walking, running, skating, etc.; that is, in locomotion.

The Cerebrum.—The cerebrum occupies the top, front, and upper rear part of the cranial cavity. In fact it seems to occupy almost the whole of the cavity in the cranium.

In size it is from four-fifths to seven-eighths of the entire brain. Its weight varies in different persons and in the same person at different times in life. Though it is difficult to determine an average brain weight, it is perhaps not far from 53 ounces in adult life. Daniel Webster's brain weighed 53.5 ounces, and Agassiz's, Napoleon's and Lord Byron's brain weighed about 53

ounces each. A man by the name of Rustan, an ignorant and unknown workman, had a brain weighing 78.3 ounces. Gambetta, a French statesman, "a man of indisputably high genius and ability," had a brain weighing 40.9 ounces. Of the weight of these brains, it is to be remembered that the cerebrum is about seven-eighths.

In infancy and childhood the weight of the cerebrum is not so great, and in old age it is not so great as in adult life.

The brain of persons born and reared in a cold climate is on an average larger than those born and reared in the warmer climates.

Structure of the Cerebrum.—The cerebrum is divided from back to front by a deep fissure almost into two halves, called hemispheres, one being called the right hemisphere, the other the left. This fissure is a continuation apparently of the fissures of the spinal cord, that on the top of the cerebrum being a continuation of the posterior fissure, and that on the under side of the cerebrum being a continuation of the anterior fissure of the spinal cord. This fissure, the *median fissure,* so nearly cuts the cerebrum in two that only a small portion of nervous matter, called the *corpus callosum* is left to connect the two halves. The hemispheres of the cerebrum correspond to each other as the halves of an apple cut in two correspond to each other.

Each hemisphere is divided along its outer side by a second large fissure, which is called the fissure of Sylvius. "This fissure is parallel to a line drawn from the end of the nose to the external opening of the ear,

and about two inches above it, its middle point being over the ear." Another way of locating it is that it lies almost directly under a line from the center of the eye socket to a point two inches above the external opening of the ear, this point being over the middle of the fissure in length.

Each hemisphere is also divided by another great fissure, which is called the fissure of Rolando. "It arises near the middle and a half inch above the Sylvian fissure, and extends upward and backward about four inches to the median line separating the two hemispheres."

Lobes of Cerebrum.—Each hemisphere of the cerebrum is divided on its outer surface into four pretty clearly defines lobes: the *frontal, parietal, occipital* and *temporal.*

The frontal lobes lie in front of the fissure of Rolando and above the fissure of Sylvius. They occupy the whole front part of the cranial cavity.

The parietal lobes lie above the fissure of Sylvius and behind the fissure of Rolando. They occupy the whole top portion of the cranial cavity behind the fissure of Rolando.

The occipital lobes lie in the back portion of the cranial cavity below the parietal lobes and above the back portion of the temporal lobes on the sides.

The temporal lobes lie below and behind the fissure of Sylvius along the sides of the cranial cavity.

Convolutions.—Each lobe of the cerebrum is divided into several convolutions by little winding ditches, called

sulci. The areas between the sulci are the convolutions, and not the ditches as sometimes understood.

Matter of Cerebrum.—The cerebrum is composed of both white and gray nervous matter. The gray matter forms a thin covering over the white matter in each hemisphere. It has been compared to the peel of an orange. This covering of gray matter is the *cortex.* It is of different thickness in different persons, but will perhaps average one-tenth of an inch in thickness. In some brains it is one-eighth of an inch thick and in some not more than half so thick. Daniel Webster had a cortex one-sixteenth of an inch in thickness.

Within, the cerebrum is almost wholly a great mass of white matter consisting of nerve fibers. There are though ganglia of gray matter scattered around to some extent among the fibers. The cortex is made up almost wholly of nerve cells.

Functions of the Cerebrum.—The functions of the cerebrum are no doubt various, but the most important is that it contains the centers of all action we can rightly call mental. The centers of consciousness, attention, perception, judgment, reasoning, love, hate, and the will are in the cortex of the cerebral hemispheres.

CHAPTER IV.

ACTIVITY.

Nature of Activity.—The mind sees objects in one position at one time and in other positions at other times. Thus we see a man in Chicago and some time later we see him in New York; we see a bird on the ground, then in a tree; we see a horse in the field in one place, then in another place. Now we see the train beyond the bridge, then this side the bridge. We say the objects have *moved, changed,* or *acted.* Do we see objects move, or do we see them in merely different places at different times? If the object does not seem to come to rest in different places we say we see it move, but if we see it in one place now, and later see it in another place we say we see it has moved. But we are just as certain in one case as in the other. Strictly speaking we do not see motion, nor do we see the object move. We see the object in different places at different times, for which we can account only by believing it moves.

Again we see an object in one condition at one time and in a different condition at another time. Thus we find the road, muddy to-day, solid to-morrow; covered with snow a short time ago, bare now. We find our friends sorrowful now, happy at another time; in a good humor now, angry at another time. We find the stove hot now, cold at another time; new now, old at

another time. We find ourselves feeling well now, bad at another time; vivacious now, weary at another time. And we say all these things change, act or move. We can account for their being in different conditions at different times in no other way.

It will thus be seen that change, activity, and motion are but the presupposition of the mind's thinking objects in different positions or conditions at different times. The following is the definition for activity:

Activity is the presupposition of the mind's thinking objects in different positions or conditions at different times.

Classes of Activity.—In our studies at present we are concerned with the activity only of the human mind and human body. In considering such activity we have not to observe very long to see that there are activities of both the mind and the body which go on without our intentionally directing them; also, that there are activities of both the mind and the body that we do intentionally direct. These differences among our activities give basis for the following classes:

1. Involuntary activity.
2. Voluntary activity.

Involuntary Activity.—Observation shows us that some of the activity of the body, such as coughing, sneezing, heart-beating, etc., is carried on without our intentionally directing it; also, that mental activity occurs in the same way, as the wandering of our minds from object to object when we sit down to rest mentally and physically. Mental activity thus as well as physical

activity is involuntary. The following is the formal definition for involuntary activity:

Involuntary activity is that kind of activity which the mind does not intentionally direct.

Voluntary Activity.—Again observation of our activities reveals to us that such activities as writing, throwing, picking up objects, playing tennis and sewing are physical activities which are intentionally directed. Also that such activities as solving problems in mathematics, analyzing sentences in grammar, studying an experiment in science, or interpreting a piece of literature are mental activities which are intentionally directed. Thus again both physical and mental activities are voluntary. The following is the formal definition for voluntary activity:

Voluntary activity is that kind of activity which is intentionally directed.

Reflex Action.—If the foot of a sleeper is pricked he will often withdraw his foot without ever knowing anything about it. If a decapitated frog has acid placed upon its leg or flank it will use one or both feet to brush it away. "If the soles of the feet of a man whose spinal cord is injured anywhere above the sacral region be tickled, it often happens that his legs will be suddenly drawn up, though the man cannot feel the tickling, and can not of his own will draw up his legs."

Again a loud report or a sudden motion toward the eyes makes one jump unintentionally.

It should be noticed in all such action first that the action is muscular or glandular and, since muscles act only in response to nervous action, also nervous; that is

neuro-muscular or *neuro-glandular* action; secondly, that there is always an *external stimulus;* and thirdly, that the action is *uncontrolled by the mind.*

Such action as the action studied above is *reflex action,* and the following is the formal definition for it:

Reflex action is that kind of action caused by some external stimulus and uncontrolled by the mind.

Or a second way of putting it is as follows, since it is action not intentionally directed:

Reflex action is involuntary neuro-muscular or neuro-glandular action caused by some external stimulus.

The Process.—The process of reflex action is as follows: a disturbance is caused in some nerve center by an external stimulus; without being transmitted to the higher nerve centers of intentional control, or before the higher nerve centers of intentional control have time to act, an impulse is sent out and produces muscular action. The nerve centers which control reflex action are mostly found in the spinal cord, but there are also reflex centers in the brain.

Classes of Reflex Action.—In the case of the man who draws his feet up when they are tickled, there is no consciousness of the stimulus nor of the action; but in the case of the one who jumps because of the loud noise, there is consciousness of both the stimulus and the action. These differences give basis for two classes of reflex action.

1. *Unconscious.*
2. *Conscious.*

Illustration.—When the dim rays of light come into the pupil of the eye they act as a stimulus which causes

the muscles of the iris to so act as to enlarge the pupil. Also when too bright rays come into the pupil they cause the muscles of the iris to so act that the pupil is made smaller.

The presence of the food in the stomach acts as a stimulus which causes the stomach to blush; and the food in the intestines acts as a stimulus which causes the liver to secrete the bile. All these are illustrations of *unconscious reflex action.*

Illustration.—A little thought shows us that in coughing and sneezing we are most usually conscious of both the stimulus and the action. So coughing and sneezing are frequently good examples of conscious reflex action. We are frequently painfully conscious of both the stimulus and the action and try in vain to prevent the action, or to remove the stimulus. Also when we jump at a loud noise we are conscious of the stimulus and also of the action. Such are good examples of conscious reflex action.

Further Classes of Reflex Action.—By observing reflex action from another point of view we see that such instances of it as coughing, sneezing, and the movements of digestion are reflexes with which we are born. But if one strikes his foot against something and starts to fall, his hands will be thrown out to break the force of the fall, and many movements in walking, skating, riding a bicycle, which many authors call reflex, if reflexes, are not those with which we are born. These differences in these actions give basis for the following:

1. Original reflex action.
2. Acquired reflex action.

Original Reflex Action.—It is perfectly clear that one is born with many reflexes. In addition to those mentioned above are winking, the secretion of saliva, the secretion of tears, and the adjusting of the eyes to see objects near and far.

Acquired Reflex Action.—In cases of walking, skating, etc., it is not clear to every one that they ought to be called reflex action. They are acquired without any doubt, but they seem to be actions which were at one time voluntary but have become more or less automatic. A definite external stimulus is lacking. However, they are considered by some authorities as acquired reflex actions, and if there be such action, they are examples of it.

Functions of Reflex Action.—The functions of reflex action are at any rate three:

1. To carry on the routine work of the body.
2. To carry on functions of the body when one is unconscious.
3. To protect the body in cases which require quicker action than action intentionally directed.

Impulsive Action.—It is necessary for us to remember that *an impulse is an excess of energy,* or *a surplus of force.* Children often when they are asleep throw their hands, legs and feet about, also their whole bodies. Such actions are caused by the tension in the nerve centers due to the excess of energy stored there. This tension is probably due to the effect of the blood on the nerve centers. At any rate there is no doubt that the tension exists and when it becomes too great an impulse starts from the nerve center and produces action. Such action is called *impulsive action.* Persons who have many

impulsive actions are called *nervous persons.* The following is the formal statement for impulsive action:

Impulsive action is that kind of action caused merely by an impulse arising from the tension in the nerve center.

Kinds of Impulsive Action.—Some cases of impulsive action are purposeless; that is, they are not put forth to do any useful work. Of such impulsive actions, the child's throwing itself about in its sleep, and protruding and chewing its tongue when learning to write are examples.

Again in such impulsive action as breathing and heartbeating the action is purposive; that is, it is put forth to do some useful work. These differences give basis for dividing impulsive action into the following classes:

1. Purposeless impulsive action.

2. Automatic action, or purposive impulsive action. *Thus automatic action is action resulting from impulses originating in nerve centers without the stimulus to an afferent nerve fiber.*

Kinds of Voluntary Action.—Voluntary action, or intentionally directed action, is of two kinds. First, one frequently acts without reflection. Thus some one strikes a person and he at once strikes back. The bell rings and one starts to his class. One sees some body fall down and stops to help him up. One claps his hands when he has listened to a piece of music.

Again one contemplates taking a journey, or buying a farm, or going into business and reflects sometimes for

a long time on such action. These differences furnish basis for dividing voluntary action into two classes:

1. Unreflective.
2. Deliberative, or reflective.

CHAPTER V.

MIND AND BODY.

Connection of Mind and Body.—Every one knows there is an intimate connection between the mind and body. But we perhaps at present do not know more of this connection than the mere beginning, the a, b, c of it, so to speak. We all know that prolonged physical work will produce mental fatigue, and that prolonged mental work will produce physical fatigue. Bodily injuries produce pain, but in cases of mental excitement frequently there is no pain until the excitement is over. Good news or bad news may remove hunger, and persons have been scared to death, or frightened into illness. Embarrassment makes the mouth dry and anger may make it bitter.

All these and many other facts indicate a general intimate connection between mind and body.

Effect of Suggestion.—If it is suggested to one that a certain bodily condition exists or will exist, this suggestion has much influence in producing such physical condition. Headaches and toothaches have been stopped by suggestion.

"A house surgeon in a French hospital experimented with one hundred patients, giving them sugared water. Then, with a great show of fear, he pretended that he had made a mistake and given them an emetic

instead of the proper medicine. Dr. Tuke says: 'The result may easily be anticipated by those who can estimate the influence of the imagination. No fewer than eighty—four-fifths—were unmistakably sick.' ''

Most remarkable changes of the body, even to the blistering of the skin, the change of the blood supply to parts of the body, the disturbance of digestion, and even death may result from suggestion, if various good authorities are to be believed. And suggestion here means that the person believes that the bodily condition either exists or will exist. The influence of the mind over the body is very powerful.

Opinion of Greeks.—Just what part of the body the mind is most closely connected with has for more than two thousand years been a subject of study. The Greeks studied this question and reached various conclusions. Plato believed that the brain is the seat of the mind, but Aristotle, the greatest Greek philosopher, rejected this idea.

Brain Injury and Consciousness.—The connection between consciousness and the brain is closer than between consciousness and any other part of the body. It is well known that a blow upon the head produces unconsciousness by producing concussion of the brain. A blow on almost any other part of the body only produces pain. A blow upon the heart might produce unconsciousness, but that is because it would disturb the blood supply of the brain. Since consciousness is a mental thing, a state of the mind, this indicates connection between the brain and the mind.

Nerves and Consciousness.—It is because of the con-

nection by nerve fibers between any part of the body that may be touched or injured and the brain that the mind knows of the touch or injury. Cut the nerve fibers so that they can transmit no impulses to the brain, and the mind neither knows of an injury nor feels the pain from it. This is because the brain is disconnected from the injured part. But knowing and feeling are activities of the mind. Thus again there is no mental work without brain work, and a connection must exist.

The Blood, the Brain and the Mind.—Any disturbance of the blood supply to the brain always produces a corresponding disturbance of the mind. There is a case on record of a man who had an unusually fine memory. He had a spell of illness which left him with enfeebled heart action for more than a year. During this time his memory was almost gone. When he recovered from the disturbance to his heart action, his splendid memory returned to him. The cause of the poor memory was the poor blood supply to the brain.

Again it is a common observation that bad air makes attention and learning difficult and many times entirely impossible. This is because of the mental condition induced by blood improperly aerated acting on the brain.

Mental action causes an increase in the temperature of the brain. Dr. Lombard, a noted investigator says: "every cause that attracts the attention—a noise, or the sight of some person or other object—produces elevation of temperature. An elevation of temperature also occurs under the influence of an emotion, or during an interesting reading aloud."

"While a woman was being subjected to a test of

this sort, from no apparent cause her temperature suddenly arose. The explanation was that she had at that moment caught sight of a skull in the room.

"From experiments on animals, we learn that the active use of their senses causes a rise in cerebral temperature. A German investigator found that when he presented something not good to eat to the nostrils of a dog, the momentary sniff was accompanied by a slight rise in temperature. When a package containing a piece of meat was offered, the temperature was higher, because of more lively emotional interest."

An Italian investigator by the name of Mosso devised a table balanced so nicely that a man might lie on it without disturbing its equilibrium. By introducing some subject that quickened the action of the mind he found that thus the balance was immediately destroyed. "A sudden noise, an interesting thought, anything that increased the activity of consciousness, would cause the head end of the table to sink down as quickly as if a weight had been placed upon it." This is probably caused by an increased amount of blood in the brain.

Localization of Functions.—The brain has its work systematized to a greater or less degree. There are certain areas in it which have specific functions to perform. Not all parts of the brain engage in common in any work the brain has to do. Each part has its own specific function.

The Motor Zone is that part of the brain concerned in sending out commands to move various parts of the body. It lies on either side of the fissure of Rolando in both the frontal and occipital lobes.

"So definitely has this area been mapped out, that it is possible to find, for the purpose of a surgical operation, so small a center as that which moves the vocal cords, directs a thumb, or winks an eye."

Sensory brain areas are those which receive impulses from the sense organs. And the known ones are located as follows:

1. The centers of sight in the occipital lobes of the brain.

2. The centers of hearing in the temporal lobes of the brain.

3. The centers of smell and taste on the inner surface of the temporal lobes at the front just below the fissure of Sylvius.

4. The centers of touch probably situated in the parietal lobes.

There is an additional center known as the center of *speech,* or of Broca, from the man who discovered it, pretty definitely located. It is in the lower part of the frontal lobe of the left hemisphere of the brain just above the beginning of the fissure of Sylvius. Injury to it causes one to lose the power of speech.

Phrenology.—There are various opinions popularly held concerning whether there is any such science as phrenology. We will let the following author speak on this point: Dr. William T. Harris says: "In later times different phases of the mind came to be assigned to different parts of the body. The spleen was supposed to be the seat of hilarity and good spirits; wisdom dwelt in the heart; anger in the gall; love in the liver; vanity in the lungs."

Some other investigators located the mind in the brain, and located its functions.

"Gall, in 1789, gave the first impulse to the widespread movement under the name of phrenology. He was joined by Spurzheim, in 1804, who carried the system to England and the United States, gaining many disciples in both countries while Gall made many influential converts in Paris. Gall mapped out on the skull the locations of mental peculiarities, which he named from their excessive manifestations, organs of murder, theft, cunning, pride, vanity, on the other hand, Spurzheim attempted to systematize the organs into groups, and to name them from their normal manifestations."

Other phrenologists started out in their investigations to prove their theory more than to search for truth, and were thus handicapped in their investigations.

"But, aside from this *a priori* system of psychology based on crude introspection, a serious objection to phrenology is to be found in the fact that the so-called 'organs' are protuberances of the skull, and do not correspond to natural divisions of the brain. The 'organs' of perception, twelve in all, crowded together behind the eyes are formed by the protrusion of the outer wall of the skull, while the inner table, keeping close to the brain, leaves a 'sinus,' or chasm, between it and the outer. Moreover, the convolutions, which are distinctly marked by well established fissures or furrows (sulci), in no case agree with the 'organs' as mapped out. Some organs are located over fissures; some unite portions of different convolutions. The organ of amativeness belongs to the cerebellum, while that of alimentiveness (another

'propensity') belongs to the cerebrum. Bony processes on the skull for the insertion of muscles are (as in the case of 'combativeness') mistaken for brain protuberances. No account is made of the convolutions in the 'island of Reil,' or of those which are found in the median longitudinal fissure which separates the two hemispheres of the brain.''

These quotations sum up pretty well what the best psychologists think of phrenology. It is to say the most for it not more than a pseudo-science.

Effect on Mind of Injury to Brain.—This is well shown in the case of the young man Gage who was ''tamping a blasting charge in a rock with a pointed iron bar, three feet seven inches in length, one and one-quarter inches in diameter, and weighing thirteen and one-quarter pounds, the charge suddenly exploded. The iron bar, propelled with its pointed end first, entered at the left angle of the patient's jaw, and passed clean through the top of his head, near the sagital suture in the frontal region, and was picked up at some distance covered with blood and brains. The patient was for a moment stunned, but within an hour after the accident he was able to walk up a long flight of stairs and give the surgeon an intelligible account of the injury he had sustained. His life naturally was for a long time despaired of; but he ultimately recovered and lived twelve and a half years afterward.''

Dr. Harlow before the Massachusetts Medical Society, said the following about his mental condition: ''His contractors, who regarded him as the most efficient and capable foreman in their employ before his injury,

considered the change in his mind so marked that they could not give him his place again. The equilibrium or balance, so to speak, between his intellectual faculties and animal propensities seems to have been destroyed. He is fitful, irreverent, indulging at times in the grossest profanity, which was not previously his custom, manifesting but little deference to his fellows, impatient of restraint or advice when it conflicts with his desires, at times pertinaciously obstinate, yet capricious and vacillating, devising many plans of future operation, which are no sooner arranged than they are abandoned in turn for others more feasible. A child in his intellectual capacity and manifestations, he has the animal passions of a strong man. Previously to his injury, though untrained in the schools, he possessed a well balanced mind, and was looked upon by the people who knew him as a shrewd, smart business man, very energetic and persistent in executing all his plans of operation. In this regard, his mind was radically changed, so decidedly, that his friends and acquaintances said he was no longer Gage."

Aphasia.—Aphasia is the the loss of the power of speech, the vocal organs remaining uninjured and the intelligence unimpaired. It results from injury to the brain. If the nerve cells in the center of *speech* in the left frontal lobe of the brain are diseased or injured aphasia results from lack of ability to control the vocal cords.

Again if the nerve cells in certain places in the temporal lobes are injured or diseased aphasia results from the loss of memory of spoken words. One could

not speak his own name or that of any friend or object whatever.

Brain Size and Intelligence.—Contrary to popular belief there is no direct proportion between the size of the brain and the intelligence of the person. Brains ranging anywhere from forty to seventy ounces may belong to persons of remarkable intellectual power and distinguished ability.

Dr. Joseph Simms studied for more than thirty years this subject in North America, continental Europe, Great Britain, Asia, Africa and Australia, and is thus capable of speaking with authority concerning it. The following quotations are from him:

"Esquirol's assertion that no size or form of head or brain is incident to idiocy or to superior talent is borne out by my observation."

Dr. Simms studied the brain weights of sixty eminent men and in comparison the brains of sixty men who were not eminent, some of them being feeble-minded. The following is what he found:

"Taking, now, the sixty heaviest brains of persons not noted for intellectual greatness, we find the average to be 63.2 ounces. Comparing this with the average of sixty famous men 51.3 ounces, we find a difference in favor of imbeciles, idiots, criminals, and men of ordinary mind of 11.9 ounces."

Claims of Phrenology.—"Phrenologists assert that each organ of a mental faculty occupies a certain position perceptible on the outside of the brain, with a definite area which they have mapped out. They also hold that each of these organs extends to the center of

the base of the brain, tapering to it somewhat like a cone, having its base turned toward the outer world. They make no account of the fissures, the intervening sulci and anfructuosities that must cut many of these supposed cones, some at right and some at oblique angles. Then the large, long cavities or ventricles intercept and would hinder many of them from reaching the central, basilar part of the brain. The anatomical structure of the brain thus appears fatal to this theory of the organs.''

''The late Dr. O. W. Holmes, a learned man and experienced physician and professor of anatomy in Harvard University for thirty-five years, says: 'The walls of the head are double, with a great chamber of air between them, over the smallest and most crowded organs. Can you tell me how much money there is in a safe, which also has thick walls, by kneading the knobs with your fingers? So, when a man fumbles about my forehead, and talks about the organs of individuality, size, etc., I trust him as much as I should if he felt over the outside of my strong box, and told me that there was a five-dollar or a ten-dollar bill under this or that rivet. Perhaps there is, only he doesn't know anything about it. We will add that, even if he knows the inward dimensions of the strong box, he could not thence determine the amount of cash deposited in it.' ''

Convolutions and Intellectual Capacity.—''Large and complicated convolutions of the brain with deep sulci have been regarded by some persons as inseparable from superior powers of mind. The supposition is erroneous and groundless. The rodents, such as beavers,

squirrels, rats, mice, etc., have but little brain and no convolutions whatsoever; yet the beaver exhibits great foresight, economy, industry, and mechanical skill in building his dam, erecting his house, and storing up bark as food for the winter. Moreover, these animals live in societies and labor in union by ingenious methods for a common purpose, with nice judgment. 'So great a variety of labors,' says Dr. Leuret, 'is needed for the constructions carried on by the beaver; they include so many instances of well-made choice, so many accidental difficulties are surmounted by these animals, that it is impossible not to recognize in their actions the characteristics of a rather high intelligence.' The sheep has a much larger brain than the beaver, with numerous and complete convolutions, yet it is one of the most stupid of domestic animals. Again, though birds have convolutions in the cerebellum, they have none in the cerebrum, and yet they are more capable of education than any living beings except the human race. The eagle is complete master of the lamb; the magpie, the hawk, the raven, and the parrot with his talking powers, are not excelled in sagacity by the dog, the horse, or the elephant, notwithstanding the latter animals have brains of superior size and elaborate convolutions.

Squirrels manifest foresight and economy in storing nuts for the winter's use; yet they have no brain convolutions. The cetacea, especially whales, have much larger brains than men, with more numerous and more complex convolutions and deeper sulci; yet their intelligence bears no comparison with that of the human race."

"Idiots often possess as large brains as men distinguished for their intellectual power, and their brains have as deep sulci, and convolutions as fine, as large, and as complex. Our table of the common and weak-minded contains a mention of an idiot whose brain weighed fifty-three ounces, or exactly as much as Napoleon's, and had fine convolutions and a large frontal lobe, but who could never learn to speak.

"The elephant carries a far larger brain than man, finely formed, broad and high in front, with much more numerous and complex convolutions and deeper anfructuosities, and yet no intelligent person would for a moment claim that its mind excels or even equals that of man."

Growth and Development of Brain.—Growth of the brain means increase in weight or in bulk. At birth the brain of the average babe is near three-forths of a pound in weight or about one-eighth the weight of its body. Its brain grows very rapidly in the first four years and then slowly increases until about fifteen or sixteen when it reaches its full weight. A brain whose maximum is 1,440 grams would weigh at seven years of age 1,350 grams and at four years of age 1,325 grams, approximately. After the age of fifteen or sixteen the weight of the brain remains nearly the same till about fifty from which time on till death it loses in weight, as estimated by some authorities, at the rate of one ounce in ten years.

Brain development means a perfection of the structure of the brain. This occurs in the change in the shape and size and prolongations of the cells in the brain.

While brain growth goes forward so rapidly brain development goes on very slowly. And when brain development sets in brain growth becomes slower and after a time ceases entirely.

CHAPTER VI.

MENTAL ATTRIBUTES AND CONSCIOUSNESS.

Meaning of Attribute.—An attempt to study anything for the purpose of understanding it always consists in seeking out the attributes of that thing, and an object is known just to the degree that its attributes are discovered and learned. All knowledge thus in a general way grows out of the process of discovering and learning the attributes of objects. If one knows all the attributes of an object, he knows all there is to be known about that object. And if he knows all the attributes of any object, he knows a great deal about every object, since any object has connections with all other objects. Thus to know all the attributes there are to know would mean infinite knowledge, the knowledge of everything.

The terms, *characteristic,* or *mark,* are terms used interchangeably with the term, attribute.

Strictly speaking an attribute is indefinable, but the following statement characterizes it:

An attribute is any characteristic of an object which helps the mind in knowing the object.

Illustration.—A certain house is *large, red, new, rectangular, has* four verandas, two chimneys, *surrounded* by a big lawn, *has* two bay windows, and is *situated* on a slope. Each of the italicized words ex-

presses an attribute of the house; that is, it expresses some mark of the house which helps the mind in knowing it.

Classes of Attributes.—If we observe the attributes of objects very long we soon see that each object possesses some attributes that enable the mind to know it from every thing else. Thus in the sentence, *This* knife *in my hand* is a present from mother, the italicized words express attributes which enable the mind to know the knife from all other things. Again the tower on the east division of the old college building has some attributes which enable the mind to know it from all other things on earth. The same is true of every other object.

And again we can observe that every object in a class has some attributes that belong to every other object in the class. Thus one triangle has just three angles, and so has every other one just three angles. One man has a vertebral column and so has every other man. One dog is a quadruped and so is every other dog. One winter is colder than summer in the temperate zones and so is every other one.

Thus from this viewpoint there are two classes of attributes:

1. Particular.
2. Common.

And the following are definitions for them:

A particular attribute is an attribute which helps the mind to know its object from everything else. In the sentence, Niagara Falls is a grand spectacle, "Niagara" expresses attributes which help the mind in knowing the falls from all other things. Thus "Niagara" expresses

a particular attribute. When we talk about a *particular* object, the term, *particular,* means just those attributes which enable the mind to know the object from all other things. *Individual* is a word which means the same as particular. Thus an *individual* object and a *particular* object mean the same. Each object is a particular object, since each object has some attributes which enable the mind to know it from everything else.

A common attribute is an attribute which belongs alike to each object of a class of objects. Thus *sweetness* is a common attribute of sugar; sourness, of acid; growing feathers, of birds; and having four feet, of horses.

Classes of Common Attributes.—Again we observe that some common attributes belong to every object of the class but do not extend beyond that class; that is, do not belong to any other object besides those of the class. Thus *growing feathers* is an attribute that belongs to every bird of the class birds, but does not belong to any other object except birds; that is, does not extend beyond the class.

There are also some common attributes that belong to every object of a class but also belong to other objects; that is, extend beyond the class. Thus having two feet is a common attribute of birds, but it is an attribute also of man and monkeys.

These differences among common attributes give basis for two classes:

1. *Class common attributes.*
2. *Universal common attributes.*

The following are definitions for them:

A class common attribute is a common attribute

which does not extend beyond the objects of a class. Three-angledness is a class common attribute of triangles; growing flowers, a class common attribute of one kind of plants.

A universal common attribute is a common attribute which extends beyond the objects of a single class. Having wings is a universal common attribute of birds. It belongs to all birds, but also belongs to other things besides birds, to butterflies, for instance.

It is quite common for students to make the error of thinking that a universal attribute is one that belongs to everything in the universe. But this is just what it does not mean. There is good reason for thinking that no such attribute exists. The universal attribute is an attribute that connects a class out with other things in the universe. Thus *having wings* connects the class, *birds,* with butterflies, bees, bugs, and other things.

An Attribute of Mind.—A man can do various kinds of work. He can run, skate, cut wood, build houses, etc., but in order to do these various things he must possess various attributes. He must have weight, strength, etc. Thus *weight* and *strength* are attributes of one's body. Without these one could not run, jump, skate, and so on. In an analogous way the mind has attributes. Without these it could not do its work. The following is the formal statement for an attribute of mind:

An attribute of mind is a fundamental characteristic of mind without which mind could not do its work.

Universal Common Attributes of Mind.—The fol-

lowing is a list of the attributes of mind most valuable to study:

1. Consciousness.
2. Attention.
3. Apperception.
4. Self-activity.
5. Iterativeness.
6. Rhythm.

These attributes are as fundamental and necessary to the mind as weight or strength is to the body. They belong to all human minds but they also belong to some of the lower animals. A horse is conscious, can give attention, and is self-active. Thus these six attributes are universal common attributes of the human mind.

Consciousness.—This is the most fundamental attribute of mind. Without consciousness the mind as we think of it could not be studied or known.

One can at the start get a general idea of consciousness by comparing his condition of mind when he is very sound asleep with his condition of mind when he is awake. When he is awake consciousness is showing its influence upon the mind, but when he is sound asleep consciousness is not influencing the mind at all; consciousness is in abeyance.

If one knows, he knows that he knows or knows that he thinks he knows that he knows; that is, he knows his own mental condition. Again if one is asked a question, and he says he does not know the answer to it, it is because he knows the condition of his own mind. If one is insulted, he feels hurt or angry and he knows that he feels hurt or angry; that is, he knows his own mental

condition. If one is thinking about Niagara Falls, he knows that his mind is active; that is, he knows his own mental activities. If one is solving a problem in arithmetic, he knows that his mind is active on arithmetic; that is, he knows his own mental activity. The mind thus knows itself.

What enables the mind thus to know itself; that is, its own conditions and activities? Consciousness. The mind is able to do this because of the attribute of consciousness. Thus we reach the following statement for consciousness:

Consciousness is that attribute of mind by virtue of which the mind knows itself; its own conditions and activities.

Thus by virtue of consciousness the mind is different from anything else known to us. Mind is the only thing that can know itself. Through consciousness the mind knows its own sorrows, pleasures, pains, hopes, aspirations, successes, disappointments, loves, hates, ideals and motives, and it knows it knows these, and knows itself as the knower.

Classes of Consciousness.—If one observes his own consciousness by means of introspection he will see that at some times he seems to be conscious of what is in his own mind. Thus we ask one what he is thinking about and he says he is thinking of his own thinking; that is, of what is, so to speak, passing through his mind. Thus one thinks of his own motives or intentions. Or he thinks of his own sorrow or depression.

At another time one seems to be conscious of something not in his mind. Thus one seems to be conscious

of a friend, a house, a tree, a flower, a dewdrop or an ocean. These differences in consciousness give basis for two classes of consciousness. First, that kind by which we seem to be conscious of some object outside the mind. Secondly, that kind of consciousness by which we seem to be conscious of something in the mind.

1. *Objective consciousness.*
2. *Subjective consciousness.*

The following are the formal statements for them:

Objective consciousness is that kind of consciousness by which the mind seems to be aware of something outside the mind.

Subjective consciousness is that kind of consciousness by which the mind seems to be aware of something within the mind.

Objects of Consciousness.—Observation shows us that we may be conscious of, in general, two kinds of things: first, *physical* things; secondly, *mental* things.

Nature of an Object.—The true idea of an object is frequently not to be found in the minds of those who should have it. In fact many persons have but a restricted idea of an object. It is quite common to find persons who think only those things which occupy space and have weight are objects. To such persons such things as trees, rocks, houses, horses, etc. seem to be objects, but such things as character, honor, beauty, virtue, wisdom, etc. do not seem to be objects. The view that only those things which possess weight and occupy space are objects is narrow and erroneous.

The derivation of the word, *object,* furnishes a key to the right idea of what an object is. The word is from

ob, against, and *ject, thrown.* Thus an object is anything which is *thrown against* the mind as a challenge to its activities. That is to say, anything the mind thinks about is an object. The following is the formal definition for an object:

An object is anything about which the mind can think.

Classes of objects.—Observation shows us that the mind sometimes thinks of such objects as flowers, trees, men, horses, books, and mountains; that is, about objects which *occupy space.*

And again the mind thinks about such objects as honor, virtue, character, purity, whiteness, sweetness, love, hate, sorrow, misfortune and happiness; that is, about objects which *do not occupy space.* This difference in objects about which the mind thinks furnishes basis for two classes of objects: 1. Material. 2. Immaterial.

The following are the formal definitions for them: *A material object is an object which occupies space. An immaterial object is an object which does not occupy space.*

The things which the mind is conscious of are thus both physical and mental . That is to say, the mind is conscious at some times of material objects and at other times of immaterial objects.

Fields of Consciousness.—If one examines his mind carefully by introspection he will find that at almost any time when he is awake there are many things more or less in one's mind. For instance, one sits in the library reading a book. The content of what he is read-

ing is in his mind, so are various sounds, other persons in the library, the trees which appear through the window, book cases, the touch of his clothing, and so on, perhaps. It is true that most of these are only dimly in the mind, but in the mind all the same. Thus what one has in mind at any one time constitutes a kind of *conscious field.*

Again we observe that most of what we have had in our minds in the past and what we say we know we do not have in mind at any one time. Indeed we have very little of what we know in our consciousness at one time. So there is a great field of what we have known which constitutes a sort of subconscious field. These differences in our minds give grounds for the two classes of conscious fields.

1. The *conscious field.*
2. The *subconscious field.*

The Conscious Field.—The conscious field consists of all that one has in consciousness at any one time, either dimly or clearly. One's conscious life is a succession of these fields. They always have various things in them; that is, they are *complex.* "They contain sensations of our bodies and of the objects around us, memories of past experiences and thoughts of distant things, feelings of satisfaction and dissatisfaction, desires and aversions, and other emotional conditions, together with determinations of the will, in every variety of permutation and combination."

The conscious field always has something in it which is clearly in consciousness. This is called the *center,* or *focus* of the conscious field. All of those things in the

conscious field which are but dimly in consciousness constitute what is called the *margin* of the conscious field.

The Subconscious Field.—The subconscious field is made up of all that the mind has ever had in consciousness but which it does not have in consciousness at any time. "At any one moment we are not conscious of a thousandth part of what we know. It is well that such is the case; for when we are studying an object under a microscope, trying to memorize poetry, demonstrating a geometrical proposition, or learning a Latin verb, we should not want all we knew of history and physics, or images of the persons, trees, dogs, birds, or horses, that we remembered, to rush into our minds at the same time. If they did so, our mental confusion would be indescribable."

Differences in States of Consciousness.—By observation through introspection it may be seen that our conscious states differ in the following respects:

1. They differ in *intensity.* At one time, one is slightly in pain; at another, in excrutiating pain. At one time, one is a little sad; at another crushed with sorrow. At one time, one is studying slightly; at another, very hard.

2. They differ in *quality.* At one time, our consciousness is painful; at another time, pleasurable. At one time, our consciousness is one of surprise; at another time, one of being bored. These differ in quality.

3. They differ in the *extent* of the conscious field. Sometimes there are but few things in the conscious field compared with what there are in it at other times. If

one were intently studying the petals of a primrose in his hand his conscious field would be narrow as compared with his conscious field when he is looking at a landscape in the distance.

4. They differ in the *speed* with which objects cross the conscious field. At one time, ideas succeed each other very slowly in consciousness; at another time, they jostle each other in a mad rush, and go cross the conscious field at a galloping pace.

Functions of Consciousness.—Consciousness has several functions, the chief ones of which are as follows:

1. *It enables the mind to know one mental experience from another.* This function is of the highest importance to the mind. If the mind could not tell one mental experience from another it could not know a pebble from a pumpkin; a dewdrop from an ocean; a man from a mushroom; a mouse from a mullen stalk; a hat from a hammer, nor a cabbage from a carrot. In short, one could never get started in getting knowledge.

2. *It enables the mind to know the value of its experiences to itself.* Without this function of consciousness the mind would never know what of its experiences to avoid and what to repeat. It could not tell which are good for it and which are bad for it. It could not tell whether good intentions or bad intentions are to be cultivated.

3. *It enables the mind to direct its activities so as to do mental work.* Without consciousness the mind's activities would scatter over all creation as they do in dreams. No one thing could be held in mind long enough to be thought out. Mental activity would waste

itself in aimless wandering, if consciousness did not cling to some purpose.

4. *It enables one properly to estimate himself.* Since consciousness enables one to know the condition of his own mind, it enables him to estimate himself. It enables one to know how much he knows, how much his knowledge is limited, the purity of his motives, the quality of his intentions and the strength of his will power; in short, to know himself.

Education of Consciousness.—One's consciousness is educated when it reveals accurately to him his mental conditions. The difference between the man whose consciousness is educated and the one whose consciousness is not educated lies in the fact that one whose consciousness is educated knows pretty accurately his own worth, while the one whose consciousness is not educated usually either overestimates or underestimates himself. Consciusness becomes educated by study and research, just as one grows in any kind of education.

CHAPTER VII.

ATTENTION.

Nature of Attention.—The most persistent thing of which the human soul is conscious is change. Changes in the mind's environment and changes in the mind itself are the things studied in every study of the mind. Any one of these changes definite enough to be separated from other changes is *an experience.* Thus an experience is a change of some sort, and a mental experience is a mental change of some sort. Mental life is a succession of these changes or experiences, and so is physical life.

Most of our mental experiences go forward without the mind's being *clearly* conscious of them. The mind though has the power of bringing any experience *clearly* into consciousness and of focusing its energy upon it after it is in consciousness. This the mind is able to do because of the attribute of *attention.*

Thus the mind is able to do the two following things because of attention:

1. The bringing of some experience *clearly* into consciousness.

2. The focusing of its energy upon it.

A little introspective study shows that at most times there are many things in one's mind. As one sits

in his study he sees books, furniture, pens, pencils, papers, the scenery outside his window, and many other things; he, perhaps, hears children shouting at play, the singing of birds, the cackling of chickens, the rushing of the train, the clatter of wagons on the road, the ticking of the clock, and so on. In short, a large number of things are more or less in his consciousness. Most of these things, or better the experiences aroused by these things, are only dimly in consciousness. But because of the attribute of attention the mind is able to exalt any one of these dimly conscious experiences into clear consciousness. And this is the first thing the mind is able to do because of attention. It is a differentiating function of the mind. It is the process of separating one experience from a more or less integrated mass forming a substratum in consciousness.

The second thing which the mind can do because of attention is that of narrowing down the field of consciousness. It is what is usually called *concentration.* It is somewhat analogous to focusing the rays of the sun by means of a lens, which consists in narrowing down the focal field by converging the rays toward a point.

From the above study the following definition of attention is reached:

Attention is that attribute of the mind by virtue of which the mind brings some experience clearly into consciousness and focuses its energy upon it.

Illustration.—One is sitting in his room engaged in reading the morning paper. The clock is sitting upon the mantel shelf ticking away as loudly as usual, but he does not hear it clearly, though there is a sort of dim

consciousness of its ticking. Suppose some one says "How clearly the clock ticks!" Immediately he hears it clearly. That is to say, the mind brings clearly into consciousness the experience aroused by the ticking of the clock and focuses its energy upon it.

Condition of Attention.—There are certain conditions which must exist in order to have attention of any kind, good, bad or indifferent. These may be grouped as follows:

1. The condition of the self stimulated.
2. The nature of the stimulus stimulating.

In order to give good attention one must have a normal healthy nervous system and a normal mind in a healthy natural condition. No one suffering from disease, fatigue, worry, inferior or unhealthy nervous organization can rightly be expected to give vigorous and prolonged attention. It is a physical and mental impossibility. This may be summed up in the statement that one condition necessary to vigorous, prolonged attention is a healthy vigorous tone of the self, both mental and physical.

From the student's point of view there are at any rate four things fatal to habits of vigorous, concentrated, prolonged attention. They are as follows:

1. Food insufficient in quality or quantity.
2. Insufficient physical exercise.
3. Insufficient pure, fresh air.
4. Insufficient quantity of sleep.

Food insufficient in quantity and quality affects the vigor and tone of the whole being physically. And the

relation between physical and mental is so close that the power of attention suffers in a corresponding degree.

It is a law of life that a healthy state of any organ or system of organs is maintained only by a healthful amount of exercise. Lack of exercise brings on languor, ennui and blase. These conditions, due to the dependence of one's mental life upon the physical, make strongly against attention.

Bad air is the bane not only of health in the schoolroom, but of comfort, vivacity and all that goes to make school life a pleasure and a success. Every adult should have 3,000 cubic feet of fresh air per hour, or fifty cubic feet per minute as the minimum for the *best* attention. Of course, people can live on a smaller quantity of fresh air. It is not the intention to say they can not. But it is the intention to say that vigorous, prolonged, concentrated attention can not be maintained to its maximum under any other conditions.

Lack of sleep is a common and prolific source of poor attention in school work. No one who is sleepy can give very good attention to anything. It does not, however, seem generally to be understood that every one should have as the minimum seven hours of sleep in every twenty-four preferably in a majority of cases from 11:00 p. m. to 6:00 a. m. It is worthy of emphasis that this is the minimum. It is also true that in the cases of most persons more than seven hours in twenty-four are demanded. Again it is not the intention to say that one can not live on fewer than seven hours of sleep in every twenty-four, but it is the intention to say that he can not feel vigorous, happy,

sweet-tempered; in short, be his best self, continuously on less than seven hours of sleep in every twenty-four. It is certainly a well established truth that good attention demands seven or more hours of sleep in every twenty-four.

The kind of stimulus has much to do with the attention. The reason why some things in themselves seem to attract and hold the attention is due to the stimulus they furnish. A blinding flash of lightning or a terrific crash of thunder will attract one's attention under almost any set of circumstances. A runaway horse dashing down the street will do the same thing.

A story is told of a clergyman who, talking in loud, monotonous tones, was astonished to see many of his congregation sleeping. He spoke a sentence or two in a hollow whisper and several of them awoke with a start. Thus change in the stimulus attracts attention. It is the quality of the stimulus which the teacher manipulates in holding the attention of his students.

Classes of Attention on Basis of Direction.—At times one seems to be attending to things outside of his mind, and at other times he finds himself attending to things in his mind. Said in another way, sometimes one's attention is directed inward and sometimes outward. Thus on this basis there are two classes of attention, and they are called:

1. External.
2. Internal.

External attention is that kind of attention the stimulus of which is outside the mind.

Internal attention is that kind of attention the stimulus of which is in the mind.

Illustration.—If one is sitting at his window and watching intently the frolics of the jaybirds among the trees upon his lawn, his attention is *external.* But if he is thinking of his own motives, hopes, aspirations, likes, dislikes, and so on, his attention is the *internal kind.*

Classes of Attention on Basis of Effort.—By introspective study of our own attention we discover that at some times we give attention without any seeming effort, while at other times conscious effort is required to give attention. In the first case the attractiveness of the stimulus is so great that the mind is held to it without any apparent effort, while in the second case the stimulus fails to hold the mind. In either kind of attention there is involved *some* effort, but in the one kind the effort is not a *conscious* one, while in the other there is peculiarly a *conscious* effort. This difference in attention gives basis for dividing attention into two classes:

1. *Non-voluntary.*
2. *Voluntary.*

The following are formal definitions for them:

Non-voluntary attention is that kind of attention in which no conscious effort is involved.

Voluntary attention is that kind of attention in which a conscious effort is involved.

It is popularly thought that voluntary attention is a much higher kind than the non-voluntary and that it is the kind possessed by men and women of great ability, by geniuses. In fact one frequently hears it said that the only difference between the genius and the ordinary

man is in the power of voluntary attention. A little introspective thought, though, shows that voluntary attention is not of long continuous duration with any one. When the mind strays away from the object of attention, by and effort it is hauled back and forced upon it. But if the mind stays there very long, it will be found that what was voluntary attention has changed into the non-voluntary kind and the mind is held by the attractiveness of the stimulus. Unless there is such attractiveness about the object of attention, the mind can not stay there and no attention of any kind will exist for it. The effort of attention will prove to be spasmodic attempts at short intervals to hold the mind upon some object of consideration. Thus voluntary attention is a momentary affair and is itself very quickly exhausted in the effort.

The attention of the genius is almost wholly of the non-voluntary kind. He attends with concentration to any object under consideration for a long time because it awakens so many new and interesting connections and suggests all sorts of pleasant associations, thus opening up various and multiform avenues of thought.

To the ordinary man not so richly endowed the connections are fewer, and since there is nothing to hold the mind, it soon wanders, and it is said to lack concentration. Thus the ordinary mind has much more opportunity to exercise voluntary attention than the mind of the genius. It is much more of a necessity for the ordinary mind to exercise voluntary attention than it is for the mind of the genius.

Basis of Attention.—The basis of attention is

interest. And by this is meant the mind gives attention to that in which it is interested and does not give attention to that in which it has no interest. This is true, but what is interest?

To the mind dissatisfied with vagueness, it is hardly sufficient merely to say or think that interest is the basis of attention. The meaning of interest must be made more definite.

An examination of various cases of interest shows that when one is interested in a thing he has a *feeling* for that thing. Thus one's interest in a thrilling story is his *feeling* for that story; and a child's interest in sweetmeats is his *feeling* for sweetmeats. Thus interest is a *feeling.* But in interest there is always the additional thought that the object or action in which the mind is interested is the cause of the feeling, and the mind so regards it. Thus the following definition of interest is reached:

Interest is any feeling for an object or action which the mind regards the cause of the feeling.

One's interest in art is his feeling for art, the mind regarding the art as the cause of the feeling. And a man's interest in his family is his feeling for his family accompanied by the idea that the family is the cause of the feeling.

Classes of Interest.—An examination of one's interests shows that he is interested in some things because of themselves and in some other things not because of themselves, but because they are a means to some other thing. Thus much of the routine of daily labor is done because not of interest in it as an end, but because of interest in

it as a means to something beyond, the money received for it or some other kind of remuneration. One's interest in an absorbing piece of music or a thrilling narration points to nothing beyond itself. It is exhausted in the act. This difference in our interests is basis for classifying them into:

1. *Direct.*
2. *Indirect.*

The following are definitions for these two classes of interest:

Direct interest is that kind of interest which the mind has for something as an end.

Indirect interest is that kind of interest which the mind has in something as a mere means to an end beyond.

Direct interest is the interest with which one works when he loves his work. It is the interest which furnishes the basis for most of life's happiness. It is the only kind of interest which is an effective guarantee of good work. Work in which there is a direct interest is invariably better done, and there is much pleasure in doing it. Work done with only an indirect interest is drudgery and the tendency always is to slight it.

The art of correct living is largely included in learning to do one's work with a direct interest in the necessities and vicissitudes of daily life. All work however humble or hard may thus have pleasure in it.

From the teacher's point of view the aim should always be to secure direct interest from the children in their work. And the teacher who is able to do this largely find his opportunities for helping his children broad, and his satisfaction in his own endeavor deep.

No teacher, though, can secure direct interest from all his pupils at all times. The varying conditions of life, the influences of heredity, the previous environment and disposition of children with their limitations of knowledge make it many times an impossibility. From which it turns out that some aspects of school work will always be drudgery to some children, much the same as some aspects of life's work will always be drudgery to many people. In such cases the work must be done with an indirect interest.

People are often unaware that they are criticising themselves when they say that they can not get interested in this or that. The natural healthy attitude of the mind is interest in all things . And to be unable to get interested in a thing is a sure indication of an unhealthy attitude of mind or of a mind with such a small store of knowledge that the new thing has few or no connections, or associations, or it may be an indication of both, as it frequently is. One who says he can not get interested in a thing is thus saying that he is so ignorant, that he does not know enough about it to be interested or that he is not healthy in mind. Thus one who is not able to get interested in a subject should look within for the difficulty and not outward. He will also do well to keep still about it, unless it is the desire to show an abnormal, unhealthy condition of his soul or an undeveloped ignorant state of the self.

From the above it is seen that people's interests are quite usually too shallow and too narrow. That is to say, most persons are not deeply enough interested in enough things. Most persons have a sort of fleeting shallow in-

terest in many things, but an intensive interest in a very few things. Thus their lives are touched very lightly by most things, and they live only a very small part of life's possibilities. Their lives can not be full and rich and strong. Only deep life interests in many things can make the current surge full and strong.

The Law of Interest.—The question, Why is one interested in a thing at all? suggests itself. If one studies his own interests for a short time, he will find that he has interest in that which gives or promises *pleasure* or *pain.* If one is interested in studying or reading Tennyson's Bugle Song, it is likely to be because it gives him pleasure. The pleasure one has in a thing may be sensuous or intellectual, real or imagined. The child is interested in an apple or a stick of candy because of the sensuous pleasure it furnishes him. The advanced student is interested in his algebra problem because of the intellectual pleasure it furnishes him.

The boy is not interested in a strapping he is experiencing because of the pleasure it furnishes, but because of pain. The traveler lost in the forest is not interested in the howling wolves because of the pleasure the howling of the wolves furnishes, but because of the pain, but he is just as truly interested.

Thus not only agreeable things but disagreeable things as well awaken interest. There is more than one way for a thing to be made interesting.

From the above study the following law of interest may be stated:

The mind is interested in whatever gives or promises pleasure or pain.

Laws of Attention.—The following are statements for some of the most important laws of attention:

1. The mind can not attend to uninteresting things.

2. Attention to an unvarying stimulus can not long remain vigorous.

3. Attention centered on an unvarying stimulus tends to produce a hypnotic or comatose condition.

4. When the mind's power of attention is fatigued it may be rested by directing it into new channels or by giving one's self up to non-voluntary attention.

Things entirely without interest never so much as find their way into consciousness and the mind can get no hold at all upon them to give them the attention. But many things which awaken a sort of fleeting interest never call forth a real effort of attention because of the shallow interest. The only way to secure effective attention is to work for deep interest. We find time always in life's frantic struggle to attend to those things for which our interests are so strong that they have become passions.

It is a common observation as well as a common experience that monotony kills attention. That is to say lack of variety, sameness in stimulus or sensation always has a deadening influence on attention. A public speaker who uses a monotonous tone fails to hold attention. A story repeated in an unvarying way ceases to hold attention.

The mental capacity for action in any unvarying direction is small, and soon becomes exhausted. As soon

as it is exhausted the attention in that direction must of course cease.

Many experiments have been conducted to show that attention to an unchanging stimulus will stupefy one and throw him into a sort of unnatural sleep or into a sort of comatose state, a semi-conscious condition.

It gives some rest when the mind becomes tired of attending to one line of work, say history, to direct it into new channels, such as arithmetic, or just to let the mind follow its own associations in a state of relaxation. Such rest, though, is only a matter of redistributing the mental energy and nervous energy. Real rest with an increase of nervous and mental power comes only from cessation of attention in sleep. Sleep is the great restorative for all sorts of mental and physical fatigue.

Importance of Attention.—"There is a constant struggle on the part of sensations to survive in consciousness. That sensation which we allow to take the most forcible hold on the attention usually wins the day. If we sit by an open window in the country on a summer day, we may have many stimuli knocking at the gates of attention." Unless we select out some one thing and center the attention upon it, nothing but mental chaos results. If we give ourselves up to every passing stimulus we belong more to our environment than we do to ourselves.

For the sake of the mental habit, one can not afford to do less than pay such attention to any public speaker, teacher, or preacher as that which would enable him to give the chief points in synopsis of the address, if called

upon to do so. Practice in doing this very thing, giving a synopsis of the address, is a most stimulating and helpful exercise in acquiring good habits of attention.

Concentration.—Concentration, the power to focus the mind's energy upon a small field of consciousness for periods of considerable duration, is frequently thought to be an absolutely necessary characteristic of marked ability. It is even thought that, if one does not possess this presumably happy power to a considerable degree, he can not amount to much as a thinker. A degree of power of concentration is a very desirable characteristic to possess, but there is a possibility of its being carried too far. Extreme concentration is absent-mindedness. It is the condition in which one forgets everything except the subject of immediate thought: forgets to eat; forgets to answer his letters; forgets to keep his appointments; forgets to speak to his friends; forgets what he goes to market for; in short, forgets a thousand things which the highest success in life demands he should remember. Then too much concentration, as well as too little, is at times both mentally and physically inconvenient.

And it is not necessarily true that one must possess the power of concentration to a high degree in order to be a success in the world. Professor William James puts this truth well in the following: "This concentrated type of attention is an elementary faculty; it is one of the things that might be ascertained and measured by exercises in the laboratory. But, having ascertained it in a number of persons, we could never rank them in a scale of actual and practical mental efficiency based on its degrees. The total mental efficiency of a man is the

resultant of the working together of all his faculties. He is too complex a being for any one of them to have the casting vote. If any one of them do have the casting vote, it is more likely to be the strength of his desire and passion, the strength of the interest he takes in what is proposed. Concentration, memory, reasoning power, inventiveness, excellence of the senses—all are subsidiary to this. No matter how scatter-brained the type of a man's successive fields of consciousness may be, if he really care for his subject, he will return to it incessantly from his incessant wanderings, and first and last do more with it, and get more results from it, than another person whose attention may be more continuous during a given interval, but whose passion for the subject is of a more languid and less permanent sort. Some of the most efficient workers I know are of the ultra-scatter-brained type. * * * * * I seriously think that no one of us need be too much distressed at his own short comings in this regard. Our mind may enjoy but little comfort, may be restless and feel confused; but it may be extremely efficient all the same."

CHAPTER VIII.

APPERCEPTION, SELF-ACTIVITY, ITERATIVENESS, RHYTHM.

Nature of Apperception.—This is another attribute of the mind without which knowing would be an impossibility and without which feeling and willing would remain undeveloped.

All learning is the mind's process of *getting meaning.* But to say this does not help much without one's having a perfectly definite idea of what *meaning* is. At first thought it seems that objects around one in the world have meaning, but a closer study shows that this is not the case. The mind in studying a thing appears to get meaning from it, it is true, but when it can not in any way connect a thing with its past experiences it gets no meaning from it. If the thing has small connection with the mind's experiences, the mind gets small meaning from it. If the thing has many connections with the mind's experiences, the mind gets much meaning. Thus in learning a thing the mind gets meaning from it just to the extent it has past experiences and can connect these with the present experiences. Now if the mind has had ever so many experiences but not like the ones the thing it is trying to learn arouses, it will get no meaning. Thus the mind connects the past and present experiences by seeing the likeness between them; but to see likeness,

there has at the least to be two things, and to be two things there must be differences. So the mind connects its experiences by seeing the likeness and differences between them.

And from the above truths the inference is that *meaning is the likeness and difference between our experiences* and is in the mind.

But what makes one thing put us in mind of another? What enables the mind to connect its experiences, the present with the past? *Apperception.* Apperception is the attribute of mind which enables the mind to do this, that is, connect the present with the past experiences.

But this is not all that apperception enables the mind to do. Apperception enables the mind to *change itself permanently* with each experience. Every experience the mind has leaves the mind a little different from what it was before it had the experience. The mind may forget the most it has learned, but it never entirely looses the effect of the activity it put forth in learning it. The mind never is again after an experience just what it was before the experience. The effect of the experience becomes organized into the self.

What Apperception Enables the Mind to Do.— From the above study it appears that the mind is able to do two things because of apperception. They are as follows:

1. *It enables the mind to bring past experiences to bear upon the present experience in getting its meaning.*

2. *It enables the mind to organize the effect of the present experience into itself.*

The mind learns only by bringing the past experience to bear upon the present. It is to be noticed that it does this consciously some times but most usually unconsciously. Thus when one sees a flower and says that it is a beautiful rose, he is not usually conscious that he is bringing his past experience to bear upon the present, but he is so doing nevertheless. In some cases one is perfectly conscious he is bringing the past experience to bear upon the present one, but usually he is not.

The organizing the effect of the experience into the self may appropriately be called *mental assimilation.* The effect of the experience becomes a part of the tissue of the mind, so to speak, as the food becomes a part of the tissue of the body through physical assimilation.

Definition of Apperception.—The following is the formal definition of apperception, obtained from the previous study:

Apperception is that attribute of mind by virtue of which the mind brings its past experiences to bear upon the present experience in getting its meaning, and by virtue of which the effect of the present experience is organized into the mind.

Illustrations.—If one who knows nothing of geology were walking down a valley and should find a rock almost round, but having a plane surface as if it were worn off by holding it on a grindstone, he would probably get much the same meaning as he would by looking at any other rock. But if a geologist should find it, he would connect his past experience with that aroused by the rock and say it called to his mind an ice age, when tremendous ice fields covered all the northern part of

Indiana. To one man it means much; to the other one, very little. Each brought his past experiences to bear upon the present, but one had little similar experience while the other had much.

A child called a jardiniere of ferns "a pot of green feathers." The child had had experience with *pots,* with *green things,* and with *feathers* which it brought to bear upon the experience aroused by the jardiniere of ferns with which it had not had experience.

A small boy called a locomotive "a big bow-wow." He had had experiences with "bow-wows," dogs, which he brought to bear upon the experience aroused by the locomotive with which he had not had experience.

The south sea islanders called Captain Cook's goats "horned hogs." They had had experiences with hogs and horns, which they brought to bear upon the experiences aroused by the goats with which they had not had experience.

In each of the above cases the present experience was connected with the past in trying to get meaning. This the mind could do because of apperception.

The Laws of Apperception.—There are two important laws of apperception as follows:

1. *When the mind sees that elements in an experience are similar to those of a previous experience, it gives the new experience the same meaning as the old.*

2. *The mind in learning naturally goes to the unknown from the nearest related known.*

Illustrations.—The first law is illustrated by the following: A little girl just learning to talk learned what a pumpkin was from playing with a large round one just

inside the garden gate. Then she called the moon, a marble, the sun, a ball and everything spherical in shape a pumpkin for a long time.

The second law is illustrated by the following: A little boy called the chicken's wings its *arms. Wings,* the unknown, was gone to from *arms,* the *nearest related known.*

Mastery of a Subject.—From the study of apperception, it is easily seen that the mastery of any subject consists of three things, as follows:

1. The understanding of the subject.
2. Fixing it in mind.
3. Stating it in good language.

The mind is able to understand any subject on account of the first thing the mind does because of apperception. It is able to fix in itself anything because of the second thing the mind does on account of apperception. Stating a thing in good language helps, also, to fix anything in mind.

Self-activity.—In a sense probably everything in the universe possesses self-activity. Physicists tell us that the little particles of the stone, wood, soil and everything else are in a constant state of motion, or activity. This however is not just the sense in which the term is used in psychology. In the study here the term will be used in its psychological sense entirely.

Nature of Self-activity.—Some idea of self-activity may be had by comparing objects which possess it with those which do not. A sewing machine acts in sewing, but always from a power without itself. A threshing machine acts, but the cause of its activity is not within

itself. All machines act in a manner similar to the threshing machine and sewing machine; that is, from a cause not within themselves. A plant acts in growing by taking food from the soil and air and making it over into plant tissue; that is, by making it a part of itself. A horse acts from a cause within himself in taking food and changing it into horse flesh; and, also, by moving from place to place, he acts. The horse moves from place to place, takes his enviroment, breaks down its individuality and makes it a part of himself. The human body acts in moving from place to place, changing itself to fit its environment to suit its needs.

The action of the plant, the horse, the human body, and also *the mind* are caused from within while the action of the machine is caused from without. The plant, the horse, the human body, and the human mind possess *self-activity,* but the machine does not. The mind is thus self-active, since it possesses the attribute by which it causes itself to act.

Definition of Self-activity.—From the above study the following definition of self-activity is reached:

Self-activity of the mind is that attribute by virtue of which the mind causes itself to act.

Law of Self-activity.—Without self-activity things never truly grow. Self-activity is at the basis of all growth. Everything which grows grows by means of self-activity. The mind grows by self-activity. The mind grows most when it is most self-active providing the activity is not carried to the extremity of exhaustion. Any activity may be carried so far that it ceases to be healthy and may result in breakdown or paralysis. Thus

the law of self-activity may be stated as follows:

The mind grows by its own self-activity and grows most when exercised to the maximum healthful activity.

Nature of Iterativeness.—This is another attribute of the mind as fundamental as consciousness or attention. In brief *iterativeness* means the tendency of the mind to repeat its phenomena.

When the muscles of the arms and fingers perform the movements in making any character in writing for the first time or in playing the piano, the activity is done with difficulty and very unskillfully. Repeated attempts give more skill and success. Each act makes the performance a little easier to accomplish. Each act affected the muscles and the mind, and this effect remained with them in the form of a tendency. That is to say when an attempt was repeated the mind and muscles tended to act so as to make the action a little easier rather than to act in some other way. Thus each act of mind or muscle leaves a tendency.

But what is a tendency? We say the growing point of the stem of a plant has a *tendency* to grow upward, and the growing point of the root has a *tendency* to grow downward. We fold a paper, and then say it has a *tendency* to fold in the same place again. We say a duck has a *tendency* to play in the water. What all these things are in the last analysis which we are accustomed to call tendencies is a mystery. We can not define a tendency, but we can characterize it as follows:

A tendency is a disposition to perform some activity.

Definition of Iterativeness.—The mind possesses the characteristic by which it has a tendency to repeat its

activities. The following is the formal definition of iterativeness:

Iterativeness of the mind is that attribute by virtue of which the mind tends to act again as it has acted.

Function of Iterativeness.—It is difficult to estimate the value of iterativeness in one's mental life. Its value is so great that it can not be overestimated perhaps. The following are some of its functions:

1. It enables the mind and body to form habits.
2. It enables one to attain skill in activity.
3. It enables one to acquire arts, as walking, running, skating, talking, writing, and so on.
4. It enables one to remember. Without iterativeness there could be no memory.

The Nature of Rhythm.—When the word, *rhythm,* is mentioned, most persons probably think of poetry and music. Poetry and music possess rhythm, it is true, but rhythm is not restricted to them. It belongs to almost everything in the world. Everything from a dewdrop to an ocean, from a snowflake to a glacier, from a pebble to a continent, possesses rhythm. Every leaf, every flower, and every blade of grass possesses rhythm.

An examination of things possessing rhythm always shows that there is some characteristic, a departure from it and a return to it, and that things not possessing rhythm fail in this characteristic. Thus in a broad sense rhythm is as follows: *Rhythm is the thing itself, the departure from that thing and the return to it.* It does not matter what the *thing* is, just so there is the departure from it and the return to it. The following is rhythmical:

"The day is cold and dark and dreary;
It rains and the wind is never weary."

In this there is the sound symbolized by *eary* in the word, "dreary." This is the thing, and "It rains, and the wind is never w——" is the departure from it. The return is the sound of *eary* in the word "weary."

In the maple leaf rhythm is manifested by a portion on the right half always having a corresponding like portion on the left half, the parts between the like parts being different. One of the like parts is the thing, that between them is the departure from it, and the other like part is the return to it. The human mind possesses this tendency to act, to depart from the action, and to return to it. This is the mind's attribute of rhythm.

Since the mind is rhythmical it likes rhythm in anything and dislikes that which is not rhythmical. The world is full of rhythm and the human mind longs for it.

Definition of Rhythm.—From the above study the following formal definition of rhythm as an attribute of mind is reached:

Rhythm of the mind is that attribute by virtue of which the mind acts and activity departs from it and tends to return to it at regularly recurring periods.

Function of Rhythm.—Without rhythm the activities of the mind as well as all other of life's activities would lack order, system, regularity and harmony. Thus the following is the function of rhythm:

1. *By rhythm the mind introduces order, regularity, system, and harmony into life's manifold and complex activities.*

CHAPTER IX.

MENTAL ACTIVITIES.

Nature of Mental Activity.—By observation of one's own mind he can see that at one time he is thinking of probably arithmetic, and at another time of grammar; at one time he is sad, and at another time happy; at one time angry, and at another time in good humor; at one time striving to direct his activities, at another time resting. That is to say, one sees his mind different at different times. And for this reason he knows that his mind changes, that he sees it in different conditions at different times.

Now mental activity is the presupposition of the mind's being in different conditions at different times.

Classes of Mental Activities.—By looking into our minds to study their activities we are able to see that at some times our minds are almost wholly occupied in thinking; again they are depressed with sorrow or elated with joy; and at other times the mind seems to be doing nothing much but striving to direct its activities and the activities of the body. These distinctions among the mind's activities give basis for dividing them into three groups:

1. *Knowing.*
2. *Feeling.*
3. *Willing.*

Order of These Activities.—The order of these activities may be seen from almost any common illustration. For instance we read of the storm which devastated Galveston a few years ago, and understood that the people were left in desolation—*knowing;* we sympathized with them and were sorry for them—*feeling;* we directed our activities to send them money, food, and clothing—*willing.* Thus in any complete act of the mind the order of development is *knowing, feeling,* and *willing.*

Nature of Knowing.—In general all *knowing is the mind's process of getting meaning.* But that this statement may not be misleading the term, *meaning,* must be thoroughly understood. Most persons, at first thought, would probably say that meaning is something which objects in the external world have. That is to say, meaning seems to be in the books, in trees, in rivers, in flowers, and so on. But strictly speaking this is an error. Careful thinking shows that things very unlike what the mind has ever experienced seem to have very little meaning for it. And this truth carried on out shows that, if it were possible to find anything entirely different from anything the mind has ever experienced, the mind would get absolutely no meaning from it. Again, two persons look at the word, *obliviscor,* and while one gets no meaning from it, to the other it means, *I forget.* So no two persons get precisely the same meaning from an object or event which they see. An object or event stimulates to an activity of the mind, and, if the mind has had past mental activities of a similar character to connect the present activity with, it is said

the mind gets meaning. Thus meaning is a thing which is in the mind. That is to say, *meaning is relation;* and further, it is the relation between present mental experiences and past mental experiences. But to trace this thought out further is to study *experience* and *relation.*

Experience will be found by accurate thought to mean any *change,* or *activity,* and any mental experience is any *mental* change, or activity.

Relation is the connection between the mind's experiences. It is the *likeness* and *difference* between the mind's experiences.

Definition of Knowing.—From the above study the following definitions of knowing are got:

Knowing is the mind's process of getting meaning. Meaning is the relation between the mind's experiences. Experiences are changes, or activities. Relation is the likeness and difference between the mind's experiences.

Knowing is the mind's process of grasping the relation between its present and past experiences.

Discriminating and Unifying.—Discriminating is seeing differences and unifying is seeing likenesses. The mind in knowing sees differences and likenesses between its experiences and thus discriminates and unifies. Thus knowing is both *discriminating* and *unifying.* The mind always discriminates *first* in knowing and unifies *secondly.* One thing necessary in knowing a maple tree is to see the difference between the mental activity it arouses and the mental activity aroused by the oak tree; and a second thing necessary is to see the likeness between the activity aroused by the maple tree and the activity aroused by maple trees in the past.

The mind is not always reflectively conscious that it is seeing the likeness and difference between its experiences, but it sees them just the same.

Thus we arrive at a third definition of knowing: *Knowing is the mind's process of, first, seeing the differences, and, secondly, the likenesses between its experiences.*

All Knowing Indirect.—There is no way for the mind to get meaning directly from an object. The past experience must always come in as a means in knowing. This truth leads to the statement that *all knowing is indirect.* That is to say, in knowing the experience aroused by any object is always referred to the past experience, and *this act of reference to the past experience* makes the knowing indirect.

Function of Knowing.—The question here is, Why does the mind want to know? What good is there in knowing? Careful reflection on this point leads us to believe that the mind needs to know *that it may direct itself and the body to act as they should.* There would be no need for knowing if there was no acting to be done. If one always knew the best thing to do next he would have no further need for knowledge. He would be as wise as he needs be. Thus knowledge ultimately has its end in activity.

Wisdom and Virtue.—Wisdom thus consists in knowing what is best to do next. If one possesses knowledge which never in any way guides in knowing what is best to do next, it is not a part of one's wisdom. It violates the origin and function of knowledge. It is useless. Thus the difference between wisdom and

knowledge appear. One is wise only to the extent to which he knows what is best to do next.

Thus *wisdom* consists in *knowing* what is best to do next under any set of circumstances, and *virtue* consists in doing it.

Nature of Feeling.—In general *feeling is the agreeable or disagreeable aspect of our experiences.* Every experience the mind has changes it both temporarily and permanently. The mind never is after an experience quite what it was before the experience. Some of these experiences change the mind for the better and some change it for the worse, but all change it permanently in some way. This change of the self by an experience is called the value of experience. The value of an experience may be stated as follows:

The value of an experience is the effect of the experience on the self.

Experiences have two values to the self:

1. *Positive.*
2. *Negative.*

If the experience is in harmony with the growth toward well-being, the experience has a *positive* value; that is, if it furthers development toward well-being, it has a *positive* value to the self. If the experience is not in harmony with growth toward well-being, it has a *negative* value. That is to say, if the experience hinders the development toward well-being it has a negative value to the self.

Now the mind has the ability of becoming aware, to a greater or less extent, of the value of experiences to itself. That is to say, the mind is aware or thinks it is

aware, at least, when it has an experience, whether the experience furthers or hinders its growth in well-being. It is no doubt true that experiences are unfavorable to the growth in well-being, even when the mind regards them as favorable. And it holds equally true that an experience may be favorable to growth in well-being, yet the mind regard it as unfavorable.

When the self has an experience, and becomes aware, or supposes it is aware, of the value of this experience to the self, the condition, or state, of mind which results is *feeling.*

Genesis of Feeling.—By genesis of feeling is meant the series of mental changes which result in feeling in specific instances. Thus one is not in sorrow, but later finds himself sad. Now, the question is, What series of changes of the self led to the feeling of sadness? This series is the *genesis* of feeling.

A careful study of the genesis of feeling reveals the following steps in it:

1. An experience.
2. Value of experience.
3. Awareness of value of experience.
4. Resultant state of mind—*feeling.*

Illustration.—A fire is pleasant on a cold day. The *pleasure* is a feeling. The fire stimulates one to an *experience.* This experience furthers one's well-being—the *value* of the experience. The mind either consciously or unconsciously recognizes this value—the *awareness* of the value of the experience. The resultant pleasure—the *state of mind,* the feeling.

Definition of Feeling.—The following definition for

feeling grows out of the genesis of feeling:

Feeling is the state of mind which results from the mind's becoming aware of the value of an experience to the self.

An analysis of this definition reveals the following points in it:

1. A state of mind.
2. An experience.
3. The value of an experience.
4. Becoming aware.
5. The self.

By state of mind is meant the *disturbed or agitated condition of consciousness.* It is a deeper thing than what is usually called a mental activity. In the activity of a muscle, the whole muscle acts together, but the individual molecules in the muscle act, too. The *activities* of the mind are comparable to the activities of the muscle as a whole, while the *state of mind* is comparable to the molecular action. It is an activity, but an unobtrusive, subtle activity of the self.

Feeling is always a *state,* or *condition,* of the mind, and is *always an accompaniment of activity or experience.*

An experience, as before seen, is any *change,* or *activity,* whatever. It is what the feeling accompanies, and what feeling *indirectly results* from.

The value of an experience is *the effect of the experience on the life of the person.* This effect is in part temporary and in part permanent. One thing about it is certain, one's experiences organize his life, build his character, for a higher or lower destiny.

Becoming aware is the recognition by the mind either consciously or unconsciously of the value of an experience to the self. The thing become aware of is thus *the value of the experience.* It is not meant that the mind always *reflectively* and *consciously* thinks out the value of the experience to the self, but that unconsciously, or implicitly, responds so as to indicate that this is what it has done.

The self in the widest sense is both the body and the mind. Thus there is a physical self and a mental self. The physical self is the self-active, self-adjusting organism called the body. *The mental self is the original power of the mind to know, feel, and will plus the effect of its experiences on it.*

Forms of Feeling.—All feeling is divided into the following large *forms, not classes*:

1. Love, or like.
2. Hate, or dislike.
3. Indifference.

Love, or Like.—When the mind has an experience which it *regards* as having a positive value to the self the feeling which arises is *love,* or *like.* The formal definition is as follows: *Love is the feeling which arises when the mind has an experience which it regards as having a positive value to the self.*

It has sometimes been taught that we can *love* only persons, and that we *like* all other things. Such teaching is purely arbitrary and unwarranted. It is entirely correct to say we love flowers, poetry, paintings, music, truth, beauty, and goodness. One finds the term, love, so used in good English.

"Any object whatever may become an object of love or hatred, though it is usual to restrict these terms to higher objects."—Dewey.

Hate, or Dislike.—If the mind has an experience which it regards as having a negative value to the self, the feeling which arises is *hate,* or *dislike.* The formal definition is as follows: *Hate is the feeling which arises when the mind has an experience which it regards as having a negative value to the self.*

Indifference.—There is perhaps no such thing as entire indifference with respect to anything, but there are various degrees of it. The term, indifference, names a mental state and it should be studied and described in psychology.

If the mind regards the experience as having little or no value to the self, the state of mind which arises is *indifference.* The following is the formal definition: *Indifference is that state of mind which arises when the mind has an experience which it regards as having little or no value to the self.*

The Function of Feeling.—It is difficult to appreciate the value of feeling in the life of the individual. Its functions can not well be overestimated. The three following points indicate these to some extent:

1. It makes life worth living.
2. It is a guide in human action.
3. It is the mainspring to all human activity.

Without feeling life would not be worth living. It is impossible to conceive what one would want to live for, if all feeling were taken out of life. No joy, no hope, no love, no happiness, nor pleasure would bless

one's life, if there were no feeling. Feeling is thus the wine of life.

Feeling is a sort of safeguard which nature has thrown around us. Feeling *always accompanies activity.* If the activity furthers the growth toward well-being, a pleasant feeling accompanies it to urge us to repeat the activity for the development it furnishes. If the activity hinders growth toward well-being, a disagreeable feeling accompanies it to urge us to avoid the activity because of the hindrance to development. Thus feeling is a guide in action. However it may seem one is always ultimately guided by his feeling.

Feeling urges to activity; that is, it is a spring to action. Everything which one intentionally does, he does because of feeling; because he *loves* somebody or something. Thus love of truth has produced *science* and *philosophy;* love of beauty, *architecture, sculpture, painting, music* and *poetry;* also, many other beautiful things; love of society, the *family,* the *church,* the *school* and the *state;* love of goodness, *ethics.*

Nature of Willing.—A short accurate statement for willing is *willing is the mind's process of controlling its impulses.*

Willing is a complex process involving both knowing and feeling, being characterized by *striving to act* in some way. The process of willing always begins with *an impulse.* Impulse is an *excess of energy,* or *a surplus of force.* Impulse produces some sort of activity.

The impulses which urge the little child to throw his arms and legs about in any direction before he is

old enough to control himself are good examples of impulses.

By a rather complex process in willing impulse is changed into *desire.. Desire is a feeling directed toward something which it is thought will satisfy that feeling.*

Desire in the process of willing is changed into *choice.* Then lastly the mind directs the activities of the self toward the *realization of the choice;* that is, toward carrying out the choice.

Definition of Willing.—The following are both accurate definitions of willing:

1. *Willing is the mind's process of controlling its impulses.*

2. *Willing is the process in which the mind changes impulses into desire, desire into choice, and in which the mind tries to realize the choice.*

An analysis of this definition shows the following points in it:

1. Impulse.
2. Desire.
3. Choice.
4. The process by which impulse becomes desire.
5. The process by which desire becomes choice.
6. The process by which the mind seeks to realize the choice.

Impulse as seen before is *a surplus of force.* It furnishes the power to make the whole process of willing go.

Desire is a feeling for anything which the mind thinks will satisfy the feeling. Thus one's desire for a drink is his feeling for the drink with the additional

point that the mind thinks the drink will satisfy the feeling. And so it is with every desire.

A careful analysis of the process by which impulse becomes desire shows the following points involved in it:

1. The mind is conscious of its real condition.
2. The mind sees an ideal condition of itself.
3. The mind compares these two.
4. The mind decides which is better.
5. A feeling of dissatisfaction arises.
6. A *desire* arises.

Illustration.—A student knows of a lecture, which arouses an impulse in him. He is at home—his real condition; he thinks of his being at the lecture—the ideal condition; he compares these two; he decides that to be at the lecture is better than to be at home; he is dissatisfied to be at home, and so desires to have himself at the lecture.

In the process of changing the desire into choice there may be involved *a conflict of desires;* that is, the mind may desire two things or more, the possession of one of which precludes the possession of the other or others. In the illustration given the student probably desired to stay at home and study his lesson, but he also desired to be at the lecture. Since he could not both go to the lecture and stay at home, there was a conflict of the two desires.

The selecting the desire to go to the lecture and dropping the other out of mind was *the choice.* Thus *choice is selecting a desire and dropping out of mind any other desire in conflict with it.* The thing chosen is thus a *desire.*

An analysis reveals the following in the process by which desire becomes choice:

1. Two or more desires before the mind.
2. The mind compares these.
3. The mind decides which is better.
4. The selecting of the better one—*the choice.*

The process in which the mind tries to realize the choice, consists in *the mind's directing the mental and physical activities to perform the deed. The directing is purely mental,* but the activities directed may be either mental or physical. In the above illustration, the mind's directing the physical activities of going to the lecture was the process in which the mind was trying to realize the choice.

The process of realizing the choice may be short or may continue through years. It may be extremely difficult and complex, and never is entirely simple.

The Functions of Willing.—Repeated acts of the will give self-control and character. Thus the functions of the will are in general two:

1. *Self-control.*
2. *Character.*

Self-control is of three kinds: *physical, prudential,* and *moral.* Character is of two kinds: *good* and *bad.*

Intellect, Feeling, and Will.—We must distinguish between a power of mind and the resulting activity. Thus one may have the power to run and not be running at all. Thus there is a distinction between the power to run and the activity of running.

Intellect is a power of mind, the power *to know.* Knowing is an activity and the intellect is the power

which is back of the activity of knowing. The following is a formal definition for intellect:

Intellect is the power by which the mind grasps the relation between its present and past experiences.

In a similar way feeling and will may be defined as powers, as follows:

Feeling is the power of having agreeable and disagreeable aspects to our experiences.

The will is the mind's power of controlling its impulses.

Opposition between Knowing, Feeling and Willing.—Knowing, feeling and willing oppose each other to some extent. Thus one can not know and feel and will to the maximum at the same time. If most of the mental energy is employed in knowing, feeling and willing are weakened. Or if one is feeling to the maximum, it opposes knowing and willing. The expression, *one is so angry he has no sense,* means feeling opposes the best work of the intellect.

All in All.—In every complete mental activity knowing, feeling and willing are all involved. There is no complete activity of the mind which is just knowing or just feeling or just willing. All are involved in every complete activity. Thus all is in all in psychology.

If the predominating element in an activity is knowing, the act is called one of knowing; if it is feeling, the act is called one of feeling; if it is willing, the act is called one of willing. Thus mental activities are named on the basis of their *predominating* element.

CHAPTER X.

THE SENSATION.

Nature of the Sensation.—The sensation is the first, most primitive, and least developed conscious mental activity which the mind ever has. It is the first conscious step in the mental changes succeeding the physical changes in one's life. It is the first conscious step across from the purely physical to the mental. It is the first consciousness resulting from external stimulus.

If one places his hand on a chestnut burr, it acts as a stimulus, which excites the peripheral nerve ending. This disturbance of the peripheral nerve ending extends along the nerve fiber to the brain and there arouses a disturbance. This disturbance of the brain is followed by a disturbance in the mind from which there results a state of consciousness. *It is this resultant state of consciousness which is the sensation.*

Thus the succession of steps leading up to and including the sensation are:

1. Stimulus.
2. Excitation of peripheral nerve ending.
3. Transmission of impulse.
4. Disturbance in the brain.
5. Corresponding mental disturbance.
6. The resultant state of consciousness, that is, *the sensation itself.*

Stimulus, as before seen, is always some kind of *motion* which comes in contact with some part of the nervous system. Thus the stimulus of hearing is motion in the air; the stimulus of sight is motion of the ether; the stimulus of touch is motion in the molecules of matter; the stimulus of the muscular sense is motion in the muscles.

Impulse is an *excess of energy,* or *a surplus of force.* Thus in the transmission of the impulse one particle of nervous matter has an excess of energy and strikes against another particle and transfers some of its energy to it; and it in turn strikes the next, transferring some of its energy to it, and so on till the impulse reaches the brain. Then the disturbance spreads and produces a small or large disturbance in the brain, depending upon the force of the stimulus and the tension in the brain.

Just how a disturbance of the mind results from the disturbance in the brain is not known. If this were known the exact connection between the mind and the body could probably be worked out. In our present state of knowledge this connection is a mystery. But we know positively that there does result a mental disturbance.

It is this mental disturbance which arouses consciousness; that is, arouses the sensation. And since one can no more be conscious without being conscious of something than he can eat without eating something, *the sensation is the consciousness of the mental disturbance.*

Definition of Sensation.—The sensation may be

defined as follows: *The sensation is the first state of consciousness resulting from external stimulus.*

The popular notion of sensation is usually vague. It is not uncommon to hear the term, sensation, used for stimulus and impulse. Sensation is often thought of as a physical thing, and is spoken of as being transmitted. No sensation is a physical thing and no sensation is ever transmitted. Four steps leading to the sensation are physical, but the sensation itself is a state of consciousness, and consciousness is purely a mental thing.

Classes of Sensations.—There are two classes of sensation:

1. *General, or organic.*
2. *Special.*

General, or organic, sensations are those which give us a knowledge of the ill-being or well-being of our bodies, and have no special sense organs. Any organ of the body which has nerves is an organ of general sensation. *Pain, fatigue, hunger,* and *thirst* are general sensations.

Special sensations are those which give us a knowledge mainly of objects around us, and have special sense organs. *Light, sound, odor,* and *flavor* are special sensations.

Characteristics of Sensations.—Sensations have three characteristics. They are as follows:

1. Quality.
2. Intensity.
3. Duration.

Quality.—The quality of sensations is the main difference between sensations. It is it more than anything

else which enables the mind to tell the differences among material objects. No two objects stimulate the mind to quite the same sensations in quality. The mind knows hot from cold, rough from smooth, sweet from sour, white from black, one man from another, and so on because of a difference in the quality of the sensations.

Causes of Difference in Quality.—There are several causes of the difference in the quality of sensations, some of which are the following:

1. *Difference in the quality of the stimulus.* This is the the main cause of the difference in the quality of sensations. The song of the robin gives different sensations from the song of a hen, the lowing of cows, different from neighing of horses. The rose gives different sight sensations from those given by the lily. A feather gives different touch sensations from those given by a stone. A carnation gives different sensations of smell from those given by the hyacinth. An apple gives different taste sensations from those given by a strawberry. These differences in the quality of sensations are all due to differences in the quality of the stimuli.

2. *Difference in the sense organ stimulated.* If the same stimulus, as an electrical current, be applied to the eye and the ear, sensations different in quality result.

3. *The time for which the stimulus acts may change the quality of the sensation.* After one looks at red for a long time it may appear green.

4. *The intensity of sensation changes its quality.*

A moderate degree of warmth is pleasant. But by increasing the stimulus the sensation becomes painful. A light gives a pleasant sensation. But increase its intensity and a place is reached where it becomes painful.

Intensity.—The intensity of the sensation means the force with which a sensation affects one. It is very well illustrated by the difference in the sensations aroused by a light of ten candle power and one of seventy-five candle power, or by the difference in the sensation aroused by a kerosene lamp and by that of an electric light.

Causes of Difference of Intensity.—The following are causes of the difference in the intensity of the sensation:

1. *The intensity of the stimulus.* The cause of the difference in the intensity of the sensation aroused by a candle and by the sun is that the stimulus from the sun is more intense than the stimulus from the candle. Also, the cause of the difference in the intensity of the sensation from the report of a rifle and from a peal of thunder is in the intensity of the stimulus.

2. *The attention the mind gives it.* If the attention is centered on the pain from a slight wound, it becomes more intense. If no attention is given to wounds they often are not at all painful.

3. *The condition of mind and body.* A noise that gives but a slight sensation when one is feeling well gives a much more intense sensation when one is not feeling well. "If we have a headache, a noise that we should not ordinarily notice may seem unbearable."

4. *Contrast in stimulus.* "Let A be a bowl of cold water; B, a bowl of hot water; C, a bowl of lukewarm water. Plunge the right hand into A, the left into B; then withdraw both and plunge them into C. The lukewarm water will seem warm to the right hand, cold to the left." Thus contrast affects the intensity of the sensation.

Limits of Sensation.—Our sensations do not acquaint us with all the phenomena of the world in which we live. In fact they acquaint us with only a small part of it. Thus the ear can not acquaint most persons with vibrations in the air below thirty per second and above 36,000 per second. There are vibrations in the air below thirty and above 36,000 per second, but we have no sensations to give us a knowledge of them.

We have no sense which gives us sensations of the vibrations of ether before they reach 18,000,000 per second, when we get sensations of heat. Then there is a jump to the sensation of light at about 462,000,000,000,000 per second, which gives red. They increase as we pass from one color to another until about 733,000,000,000,000,000 per second is reached, which gives violet. Beyond this the eye does not give us sensations, so all is darkness.

Thus our sensations are limited to a very small amount of the phenomena in the world about us. There is no knowing how the world would appear if we had a dozen more senses.

The Threshold of Sensation.—"There is always inertia to be overcome in rousing nervous matter. A

certain amount of stimulus is expended in this. If no more is added, there is no sensation. When the inertia is once overcome, the sensation will persist for a time after the cessation of the stimulus. Atmospheric vibrations at the rate of ten per second do not sufficiently stimulate the brain to render us conscious of sound. When they reach a minimum of from sixteen to thirty, they enter the threshold of human consciousness; and at a maximum of 36,000, they pass out by the upper threshold. The cat can hear sounds inaudible to man, and hence has a lower aural threshold." Thus sensations have two thresholds:

1. *Upper.*
2. *Lower.*

Intensity of Sensation not Proportional to Intensity of Stimulus.—The increase in the intensity of the sensation is not proportional to the increase in the intensity of the stimulus.

"Within certain limits, any sensory stimulus may be augmented without increasing the sensation. We should not perceive increased intensity in a sound when augmented one-fourth. An ounce might be added to two pounds without detection by the pressure sense. The additional stimulus necessary to increase the intensity of a sensation varies for different senses. Sound must be increased one-third; light, only one one-hundredth."

Thus doubling the stimulus in intensity does not double the sensation in intensity.

Duration.—The duration of the sensation has reference to the time which it lasts. Thus the difference

between a whole note and a half note of the same pitch, intensity, and quality, is in their duration. Again, some tastes endure for a long time while others disappear quickly; that is, the duration of some is greater than of others.

The Local Sign of Tactile Sensations.—There is something about touch, or tactile, sensations which enables the mind to know the point of application of the stimulus. Thus when the foot is touched the mind does not make the mistake of thinking it is the face which is touched. This characteristic of the sensation is the *local sign.* The formal statement for it is as follows: *The local sign of tactile sensations is that characteristic of them which enables the mind to tell the point of application of the stimulus.*

Aspects of the Sensation.—If one should put his hand upon a hot stove, the sensation got would (1) enable him to know something; (2) give pain; and (3) stimulate him to act. Thus there are three aspects to the sensation as follows:

1. *Intellectual.*
2. *Emotional.*
3. *Volitional.*

The intellectual aspect of the sensation is that one which enables the mind to get knowledge from the sensation. It furnishes the basis for the development of *knowing.*

The emotional aspect of the sensation is that aspect which is pleasurable or painful. It furnishes the basis for the development of *feeling.*

The volitional aspect of the sensation is that aspect

which urges to action. It furnishes the basis for the development of *willing*.

Comparison of General and Special Sensations.—The following points in the comparison of general and special sensations are worthy of study:

1. General sensations enable the mind to know the ill-being or well-being of the body; the special, mainly the outside world.

2. General sensations have no special sense organs; the special have.

3. The knowledge got through general sensations is vague, while that obtained through special sensations is much more definite.

4. The emotional aspect predominates in the general sensations; the intellectual, in the special.

5. General sensations have no special brain areas; special have.

Pain, hunger, fatigue and thirst as examples of general sensations give one only a knowledge of the ill-being or well-being of the body. This is the function of the general sensations. Color, odor, sound, flavor and so on, special sensations, give one a knowledge *mainly* of objects in the outside world, though not *wholly*. The mind can also get a knowledge of the body through special sensations.

Any part of the body containing nerves is an organ of general sensation; not so, in regard to the special sensations. Their organs are the eyes, the ears, the nose, and so on—special organs.

Pain, fatigue, and so on, general sensations, do not give definite knowledge. The knowledge got through

them is general and vague. Sound, flavor, odor, and color, special sensations, give definite knowledge.

General sensations are mainly painful or pleasurable. This is the most important thing about them. But the most important thing about the special sensations is their value to the intellect. They enable the mind to get knowledge.

General sensations are not aroused by impulses being carried to special brain areas. Any part of the cortex of the brain seems to be connected with general sensations. Sight sensations, auditory sensations and so on have special brain areas.

CHAPTER XI.

THE SENSES.

The Nature of a Sense.—A sense is wholly a *mental thing.* It is not made up of nerve endings, tissues, blood vessels nor cells. It is not a physical thing at all. It is entirely mental. It is a sense which enables the mind to get sensations. The following is the formal statement for it: *A sense is the mind's power to get sensations.* Thus the sense of sight is the mind's power to get sensations of color; the sense of hearing is the mind's power to get sensations of sound; smell, the mind's power to get sensations of odor.

"A sense is not an organ or group of nerve-ends, but a power of the mind. A sense is the mind's power to receive impressions of the outer world by means of a particular set of nerves, or part of the nervous system. For example, the sense of smell is the mind's power to be impressed through the agency of the olfactory nerves and their special connections in the brain."

Classes of Senses.—There are in general two classes of senses:

1. General, or organic.
2. Special.

Pain, hunger, thirst and fatigue are sensations got through the general sense. It will be seen that their function is chiefly to inform one of the ill-being or well-

being of the body; also, that they have no special organs. Any part of the body having nerves is an organ of the general sense. Thus the hands, the eye, the stomach, the heart and the liver are organs of the general sense. The definition of the general sense is as follows:

The general sense is that sense which gives one a knowledge of the ill-being or well-being of the body and has no special organs.

Color, sound, odor, and flavor are sensations got through the special senses. Their functions, it is seen, are mainly to give us knowledge of objects in the outside world. They have special organs. Thus the eye is the organ of color sensations; the ear, of sound sensations; the nose, of odor sensations; and the mouth, of flavor sensations. The definition of a special sense is as follows:

A special sense is that kind of sense which gives us mainly a knowledge of objects around us, and which has special organs.

The Special Senses.—The special senses are seven in numebr, though not long ago it was thought that there were only five. If they be named accordingly as they give most knowledge during one's whole life under normal conditions, they are as follows:

1. Sight.
2. Hearing.
3. Touch.
4. Smell.
5. Taste.
6. Muscular.
7. Temperature.

The Temperature Sense.—"Next to the organic sense in its generality, is the Thermal, or Temperature Sense, yielding the sensations of heat and cold. This sense was formerly not distinguished from that of touch, for the reason that its nerve ends are distributed through the skin. But experimentation finally established the fact that these sensations arise from the excitation of separate nerve ends devoted to this purpose. Some of these are susceptible only to contacts of relatively high temperature, and are known as *heat spots;* others only to contacts of low temperature, and are known as *cold spots.* These are closely interspersed throughout the skin, but may be located by the use of a metal pencil or needle. If this when heated be touched to a 'cold spot,' only the sensation of contact will be felt; the same will be true if a cold point touches a 'heat spot.' It should be remembered that 'heat and cold are only skin deep.' The temperature of the blood, and consequently of the flesh, does not vary greatly with the changes of atmospheric temperature. The temperature of the blood is confined within the range from 95° to 106° Fahrenheit, the normal temperature being from 97° to 98.5°. Sidney Smith, on a hot day, wished to 'take off his flesh and sit in his bones.' It would have answered as well to take off his skin only."

There are the two following reasons why the temperature sense is to be considered a separate sense from the touch:

1. They have separate nerve fibers and nerve endings.

2. Their delicacy does not vary in the same way

over different parts of the body. The tip of the tongue, the ends of the fingers and the lips are most sensitive to touch, while the cheek, not very sensitive to touch, is the most sensitive to temperature.

The Muscular Sense.—The muscular sense and touch are so closely connected that formerly they were not discriminated. And there are some psychologists now who do not regard it a separate sense. But it is better regarded a separate sense.

There are afferent nerve fibers which have their peripheral ending in the muscles. When the muscles act or are at rest these fibers carry impulses into the brain and there result muscular sensations. *The mental power to get sensations of motion and resistance from sensory nerve fibers having their peripheral ends in the muscles is the muscular sense.*

The chief sensations got through this sense are the sensations of *movement* and *resistance.* Both measure muscular energy which is being put forth. Without the aid of other senses the mind learns muscular movement, its distance and direction; also, the amount of energy put forth in overcoming resistance in any form whatever, weight, hardness, or rigidity.

Ideas Got from Muscular Sense.—Through the various muscular sensations the mind gets ideas of *motion, extension, distance, direction, weight, hardness, softness, rigidity* and *pliability.*

The muscular sense is thus seen to be a very important sense. It gives us the original ideas which furnish the basis for *geometry* and *physics.* Without the mus-

cular sense our progress in getting acquainted with the external world would be very slow if not impossible.

The Sense of Taste.—Taste is that special sense whose end organs are the taste buds in the tongue. This is a statement for taste in a strict sense. What is usually called taste is really a combination of three senses: taste proper, smell, and touch. It is a common observation that when anything affects the sense of smell, a bad cold, for instance, our food tastes different. And much of the pleasure which comes from eating jellies, ices, etc., is derived from touch and the temperature sense.

There are on the tongue papillae which give the roughness to the tongue, and in these papillae are taste buds. Soluble substances reduced to liquid form soak into these taste buds and stimulate them. From these stimuli there result the sensations of taste.

The distinct tastes are four in number: *sweet, sour, salt,* and *bitter.* There are many combinations of these four. Such so-called tastes as *puckery, pungent,* and *hot* are not regarded by psychologists as tastes, properly speaking. They are called mechanical effects. "All these 'mechanical effects' belong really to the class of organic sensations."

Functions of Taste.—The functions of taste are in general three:

1. It has been called the "sentinel of the stomach."
2. It gives points of knowledge about substances in the external world.
3. It gives us a great deal of pleasure.

The Sense of Smell.—The sense of smell is that

special sense whose organ is the nose . Hidden away in the upper cavities of the nose are two small patches of mucus membrane. In these are distributed the olfactory nerves, the nerves of smell. They are affected by gaseous particles of matter coming in contact with them, and there result the odor sensations.

"These nerve ends are extremely sensitive and may be stimulated by inconceivably small portions of matter. It has been calculated that three one hundred millionths of a grain of musk can be distinctly smelled; and a substance called mercaptan can be smelled in still more minute quantities."

Odors are many in number but they do not have definite names. They are usually grouped as:

1. Agreeable.
2. Disagreeable.

These terms are not definite in meaning, but very vague.

The effects of ammonia, horse-radish, pepper, snuff, and dust are not considered as sensations of smell, properly speaking. They more properly belong to the organic sense.

Functions of Smell.—The functions of smell are similar to those of taste. They are three in number.

1. Smell is a sentinel to the stomach and the respiratory organs.
2. Smell gives us ideas of many substances in the external world.
3. Smell gives us a great deal of pleasure.

"*Confusion of Taste and Smell.*—The confusion of taste and smell is a very common experience. Many sub-

stances, as fruits and cakes or confectionery containing certain 'flavoring extracts,' as vanilla, peppermint, etc., when taken into the mouth and subjected to its heat and moisture and the process of chewing, give off vapors which rise from the pharynx into the upper cavities of the nose and produce sensations of smell. These, occurring in such close connection with real sensations of taste, are not discriminated from them, and all go in as 'taste.' The so-called cooking extracts have no true tastes, but only their respective odors and certain mechanical effects due to the alcohol which they contain. The taste of onions is sweetish, where any exists; their chief characteristic, even in the mouth, being their odor and the 'strong' mechanical effect. If the nasal passages be properly obstructed, one can not distinguish by taste alone peppermint or wintergreen lozenges from each other or from those without any 'flavoring' element.''

The Sense of Touch.—Touch is that one of the special senses which gives sensations of contact and pressure. The sense organs of touch are distributed through the layers of the skin. There are several forms of these. These are special endings of afferent nerve fibers, and some of them are quite complex. There are the following of these organs:

1. Touch cells.
2. Pacinian corpuscles.
3. Tactile corpuscles.
4. End bulbs.

The organs of touch are more numerous or more sensitive in some parts of the skin than in other parts.

The tip of the tongue, the lips, and the finger tips are most sensitive, while the thigh or mid dorsal region is least sensitive. The finger tips of the blind become most wonderfully sensitive, since they have to depend upon it largely for their knowledge of the external world.

Strictly speaking the sensations of touch are only those of *contact* and *pressure*. Pressure by some authorities is considered intensity of contact.

Functions of Touch.—The functions of touch are in general of two classes:

1. Pleasure-giving.
2. Knowledge-giving.

The sensations of smoothness and softness are pleasurable. They are especially so when combined as in velvet, or the human skin. Dust and sand give pleasant sensations to the feet and hands of children. Roughness and hardness when combined into harshness are on the other hand, disagreeable.

The knowledge-giving function of touch is by far its most important function. Along with the muscular sense it gives us our most fundamental ideas of the material world.

"Thus we derive from contact, first, the idea of *extension,* and thus also of superficial form. This comes from what is known as 'plurality of points,' that is through the number of points of stimulation, or of nerve ends excited. The idea of motion may also be derived from the succession of stimulated points, as when we draw a pencil point across the skin, or in the progress of a fly or other creeping thing across the cuticle. From plurality of points, we also derive ideas of *surface,* as

roughness, smoothness, the rough surface being that in which the projecting points are relatively few and far apart, as in a rough-plastered wall contrasted with a polished surface. Some idea of weight may also be derived, as when a weight is placed on the back of a hand supported by a table."

The Local Sign of Tactile Sensations.—It will be remembered that local sign of touch sensations is *that characteristic of them which enables the mind to know the point of application of the stimulus.* Thus the mind knows pretty well just where the stimulus is applied on the skin or at how many points on the skin. This enables the mind to tell the *form* and *size* of objects.

"The accuracy of this localizing power varies greatly with different areas of the skin. This may be tested by touching the skin at two points simultaneously, as with the points of a pair of compasses or scissors, and noting the distance between them necessary to produce a consciousness of two contacts. This distance is least on the tip of the tongue, where it is only four-hundredths of an inch, whereas, on the middle of the back the points must be over two inches apart in order to be distinguished as two."

Thus touch gives the following ideas: *extension, roughness, smoothness, weight, form, distance, motion* and *size.*

"The value and importance of active touch is emphasized by the fact that it is so often employed as a court of appeal from the other senses. 'There are ghosts to all senses but one;' but whatever seems real to the touch has met the supreme test of reality. 'Let me

take hold of it,' is our demand when we distrust our other senses.''

The Sense of Hearing.—The sense of hearing is that special sense which gives sensations of sound. The sense organ of hearing is the ear. The ear is a very complicated organ consisting mainly of cavities, canals, fluids and membranes. In these are distributed the ends of the fibers of the auditory nerves.

The stimuli of hearing under ordinary conditions are *waves,* or *vibrations, of the air.* These vibrations are produced by some vibrating body.

These waves of the air disturb the ends of the auditory nerves and set up impulses which result in sensations of sound.

Classes of Sound.—Sounds are of two classes:

1. Noises.
2. Tones.

Tones are sounds produced by regularity of vibration of the air. Noises are sounds produced by irregularity of vibration in the air.

Characteristics of Tones.—The characteristics of tones are three:

1. Pitch.
2. Intensity.
3. Timbre, or quality.

Pitch, which is ordinarily called *highness* or *lowness,* of sound is due to the rapidity of vibration. A sound of the human voice produced by the vibration of the vocal cords at the rate of 100 per second is very low; one produced by the vocal cords vibrating at the rate of 700 times per second is very high.

The range of the human voice is from eighty-seven to 768 vibrations per second ordinarily, though a famous singer's voice is said to have reached a height of 1,365 per second.

The ears of most persons are capable of responding to vibrations so as to hear only between thirty and 36,000 vibrations per second. But in rare instances sounds are heard produced by from sixteen to 40,000 vibrations per second.

The middle C of the musical scale is produced by a rate of 256 vibrations per second.

Intensity of sound is usually called *loudness* or *softness* of sound. It results from the *amplitude* of the vibrations in the air. The amplitude of vibration has reference to the distance through which the vibrating medium swings. Thus if one vibrating string swings through a space of six inches and another swings through a space of twelve inches, the amplitude of the vibrations of the air produced by the second is greater than those produced by the first. Thus the *amplitude,* or breadth, of the sound waves determines the intensity of the sound.

Timbre, or *quality,* of tone is that characteristic which enables the mind to tell tones of the same pitch and intensity one from another, as the tone of one friend's voice from another, the song of the robin from the song of the thrush, the song of the oriole from the song of the cat bird, the music of the fiddle from the music of the mandolin, or of the flute from the bagpipe. It is said that the difference in quality is due to difference in *overtones.*

Functions of Hearing.—The functions of hearing are in general of two kinds:

1. Pleasure-giving.
2. Knowledge-giving.

The chief pleasure-giving value is to be found in music. Music charms, soothes, and delights the mind of everyone from the infant to the most aged.

In addition to *pitch, intensity,* and *quality* of sound the mind gets *harmony, distance,* and *direction* through hearing. These when associated with objects give the mind a great deal of knowledge concerning objects in the external world.

The Sense of Sight.—Sight has been called the *king* of the senses. Its wonderful range and its constant use during all of one's waking hours properly give it this high position.

Sight is that one of the special senses which gives sensations of light and shade.

Organ of Sight.—The eye is the organ of sight. "The organ of sight is a seemingly more simple but no less wonderful instrument than the organ of hearing. The enclosing envelope, or eyeball, consists of three coats or layers. The outer, called the Sclerotic coat, is a tough white membrane, which encloses the eye except in front, where the transparent cornea takes its place, like the crystal of a watch set in its case. Next within is the Choriod coat, a thin, black coat of great delicacy. In front, it is modified into the curtain called the Iris, the circular opening in which is called the Pupil. The iris contains certain muscles by the contraction of which the pupil may be dilated or contracted. The third or

inner coat, called the Retina, covers only the back portion of the eyeball, having the form of a cup or bowl."

The space inside these coats is filled up with humors and lenses. 1. Just back of the cornea is a watery fluid called the *Aqueous Humor.* 2. Just behind this humor is the Crystalline Lens, "a double convex lens of a jelly-like substance having considerable elasticity and enclosed in a capsule attached to the Suspensory Ligament." 3. Between the crystalline lens and the retina is the Vitreous Humor, a semifluid substance.

Stimulus of Sight.—The stimulus of sight is vibrations of *ether.* Ether is a medium which pervades all space. The vibrations of ether enter the eye in rays, or lines, of light. The waves of these rays are many in number per second ranging from 462 trillions to 733 trillions.

These rays of light pass into the eye and stimulate the retina from which result the sensations of *light* and *shade.*

Accommodation.—In order that rays of light may be focused upon the surface of the retina so as to form a correct image, means of adjusting the crystalline lens are provided. If the object to be seen is close to the eye the lens must be more convex than if it is at a distance. This adjustment of the lens to suit the eye to the distance of the object is called *Accommodation.*

In order that the student may understand accommodation, it is absolutely necessary that he have well in mind the position of the parts of the eye. Having these in mind he can understand the following explanations: "In a state of rest the front of the lens is kept some-

what flattened by the suspensory ligament, which is attached to the crystalline lens and to the ciliary processes. The ciliary processes are attached to the ciliary muscles, which is itself firmly attached to the point of junction of the cornea and sclerotic. When the ciliary muscles contract the ciliary processes are pulled forward. This loosens the suspensory ligament, and the crystalline lens by its own elasticity becomes more convex. The strain felt in looking at an object very near to the eye is the muscular feeling due to the contraction of the ciliary muscle.''—Dexter and Garlick.

''How does the lens change its curvature? The crystalline lens is elastic, that is, if its surface be made flatter by pressure, it recovers its original curvature and shape when the pressure is removed. We have seen that the lens is kept in its place by the suspensory ligament passing off from its edge to the ciliary processes all around it. The lens itself is enclosed by a transparent membrane, thicker in front than behind, called the capsule of the lens. It is to this capsule that the suspensory ligament is attached, but the suspensory ligament not only joins the capsule at the edge of the lens, but becomes directly continuous with the part of the capsule covering the front of the lens. This ligament is naturally tight, so that it is always more or less compressing the front of the lens, making this surface less convex than it would otherwise be. When we are looking at distant objects the pressure of the suspensory ligament is reducing the curvature of the front surface of the lens as much as possible, so as to make the lens weak. In this condition also is the lens when the eye is at rest, as during sleep.

From the junction of the cornea and sclerotic there are fine unstriated muscle fibers passing downwards into the ciliary processes. These form a continuous ring of delicate muscle, called the *ciliary muscle.* When this muscle contracts, the ciliary processes with the loosely-attached choroid are drawn upwards towards the origin of the muscle from the junction of the firm and immovable sclerotic and cornea. As the ciliary processes are moved they carry with them the attachment of the suspensory ligament up nearer to the lens; thus the whole suspensory ligament is slackened. When we look at a near object this muscle contracts, and so slackens the suspensory ligament, and the lens, the pressure on its anterior surface being lessened, becomes by its own elasticity more convex."—Foster and Shore.

External Muscles of the Eye.—The eyeball must be turned in various positions in seeing. There are six muscles attached to the eyeball on the outside: four straight muscles, called *Recti,* and two oblique muscles, called *Obliqui.* The *recti* move the eyeball up and down and to the right and the left. The *obliqui* run through loops which act as pulleys and move the eyes in directions between those produced by the *recti.*

These muscles are important psychologically in that sensations from them help sight in furnishing material for various kinds of ideas.

The Unaided Office of the Eye.—In adult life we get so much of our knowledge through the sense of sight, that we are likely at first thought to overestimate its original power. Though in adult life we get ideas of distance, direction, size, form, roughness, smoothness,

hardness, softness, heat and cold, not one of these ideas came to the mind originally through sight. Originally sight gives but three things:

1. Colors.
2. Combination of colors.
3. Intensity of light.

Mr. Dewey calls these three things (1) *hue,* (2) *tint,* and (3) *intensity.*

"A man who had never seen until he was thirty years old has sent to *The Problem,* a magazine for the blind, a remarkable account of his experience when the bandage was drawn from his eyes in the hospital, and he was, as it were, born again into the world.

What I saw frightened me, it was so big and made such strange emotions I called out in terror and put out my hand. My fingers touched my nurse's face. I knew she was there, for she had just taken the bandages from my eyes, and I knew what I was touching, but I did not know what it was I saw.

'For mercy's sake, what is it?' I asked. The nurse answered me soothingly, taking my fingers in her hand and moving them from her mouth to her eyes, to her nose, chin and forehead.

'It is my face that you see. Look! You know this is my mouth—my chin—and these are my eyes.'

Soon I knew that I was seeing what was familiar to the touch of my fingers—a human face. But the sensation was still one of terror. I seemed so small beside that expanse of human features which was so familiar to my fingers, so unnatural to my new sense.

When the nurse moved away from my cot, I felt a

new sensation, which was so agreeable that I laughed aloud. The nurse came back, but not so close as before.

'What is that?' I asked.

'You are looking at the blanket which lies across your feet,' she said.

'Blankets must be very beautiful things,' I said.

'It is a red blanket,' she explained.

Then I thought I knew why people spoke of the beauty of the red rose. This was my first knowledge of colors.

I saw and yet I did not know that I saw. How could I know at first that those new and wonderful sensations meant the birth of a sense of which I knew nothing except in theory? Of course I was expecting to see, but was this sight—this jumble of extraordinary sensations?

The dazzling light first convinced me, for I had always been able to distinguish between night and day. But I could not recognize objects with my new-found sense until I had translated into its speech the language of the other senses.

The one lesson of the blanket was sufficient to teach me the color, red. Yellow was a different matter. The nurse brought me a cool drink. I could recognize her by sight now. The thing I saw in her hand I knew to be a tray after I had felt it. Suddenly I felt a thrill of disgust.

'What is that thing on the tray?' I asked. 'It makes me sick.'

'It is a lemon. You said you liked lemonade.'

'Then it is yellow. It is the color that nauseates me.'

Any object close to me looked tremendously large. I had often romped with children, yet when I first set eyes on a baby it looked gigantic.

The first day I sat by the window I put my hand out to feel the pavement.

'That must be the pavement,' I said. 'I'm going to feel of it to make sure.'

'My goodness!' laughed the nurse. 'The pavement is two stories below.'

The first meal I ate was an odd experience. When I saw the great hand with a huge fork approaching my mouth, the inclination to dodge was almost irresistible.''

CHAPTER XII.

THE DEVELOPMENT OF KNOWING.

The Meaning of Development.—The best way to study knowing is to study its development. But the question, What is development of knowing? at once suggests itself. To understand this problem it is necessary to remember that *all knowing is grasping relations.* Then knowing which is developed to only a small extent is that kind of knowing in which but few relations are grasped; and knowing which is more developed is that kind of knowing in which more relations are grasped. From which it appears that *development in knowing consists in grasping more and more relations.*

To show that one kind of knowing is developed more than another kind is to show that more relations are grasped in one kind than in another.

Illustration.—If one studies a butterfly but five minutes, he knows but little about it because he has seen it in only a few relations, and his knowledge of the butterfly is but little developed. Suppose now that he studies the butterfly five months; then he may know much about it because he has seen it in many relations; that is, he has grasped many relations, and his knowledge of the butterfly is much developed. Thus the development of one's knowledge of a thing consists of

grasping more and more relations of the thing. And again the conclusion is reached that *development in knowing is gaining in the number of relations grasped.*

Stages in the Development of Knowing.—As the mind develops in knowing it passes through various stages somewhat like one's passing through stages on a journey. These stages are as follows:

1. Sense-perception.
2. Memory.
3. Imagination.
4. Conception.
5. Definition.
6. Judgment.
7. Reasoning.
8. Systematization.
9. Intuition.

Sense-perception is the least developed kind of knowing and intuition is the most highly developed kind.

Sense-perception.—In general, *sense-perception is the mind's process of getting a knowledge of material objects through the senses.*

Sense-perception is based upon and grows out of the sensation. But the sensations are not knowing. They must be connected, related and interpreted before they become knowledge. But just as soon as the mind begins to do this; that is, connect the sensations, relate and see the difference and likeness between them, it is *sense-perceiving.*

The sensations are the material which the mind works up into knowledge of external objects, as it were.

In sense-perception the mind *interprets the sensations;* that is, gets meaning—sees the likeness and difference between the present sensations and the past sensations. The following is the formal definition for it:

Sense-perception is that stage in the development of knowing in which the mind interprets the sensations from some external object.

The mind regards its sensations as attributes of objects. Thus the mind regards the sensation, *sour,* as something in the acid; the sensation, *sweet* as something in the sugar; the sensation, *green, red,* and so on as things in the objects. In this way the mind learns to interpret sensations and to know objects. Thus the mind interprets a patch of red color as a strawberry; a patch of blue color as a bunch of grapes; a certain note as a bluebird, or a certain odor as a clover field.

Memory.—Every experience the mind has changes it permanently. This permanent change is the effect of the experience. The effect of experiences is retained and this gives the mind the tendency to act the same experience again. There is no memory without this *retention* of the effect of an experience. When the mind acts an experience which it has had before it is *reacting,* or *reproducing.* There is no memory without *reacting.* These two things, *retention* and *reacting* are elements of all memory. But there must also be another element. When the mind reacts an experience, if there is a complete process of memory, it must be aware that it is reacting. This process of knowing that one is reknowing is *identifying. The present experience is identified with the past experience.* This act of *identifying* is the

third element in memory. Hence the following definition for memory:

Memory is the mental process of retaining, reacting and identifying past mental experiences.

Memory as the second stage in the development of knowing is a little higher kind of knowing than sense-perception. Sense-perception confines the mind to *present time* and *present place.* Memory goes into past time and goes beyond present places. Memory is three points beyond sense-perception in knowing: 1. It gives past time. 2. Other place relations than the present. 3. In it the mind knows that it is reknowing.

Imagination.—In brief, *imagination is the process of making images.*

The mind has the power of putting its ideas in images, or pictures. If one shuts his eyes and makes the picture of the following described apple, he is imagining:

A large dark-red apple, three inches in diameter, almost spherical, with a rotten spot as large as a finger nail on one side, and a worm hole on the opposite side, is lying on a platter sitting on a stand in the center of a room.

This image is a particular thing and is formed from a complex idea. Hence the following definition of imagination:

Imagination is the mental process of embodying an idea in a particular form, or image.

Imagination as the third stage in the development of knowing is a higher kind of knowing than memory.

The mind never remembers an object in all its exact details. Imagination enables the mind to fill out in a picture the places where memory fails. The mind can project itself into the future in imagination, too. It is also a freer act of the mind than memory.

These three advances of imagination over memory may be stated as follows:

1. The imagination fills out the incompleteness in acts of memory.

2. The imagination enables the mind to grasp future time and thus to project itself into the future.

3. The imagination is freer than memory.

Conception.—In brief, *conception is the mind's process of forming general ideas.*

In order to know an object well, the mind must see it in both its particular and general aspects; that is, must see how it differs from other things, and also how it is like other things. Some of the stages of knowing emphasize one aspect of an object and some, the other. Thus in *sense-perception, memory,* and *imagination* the mind emphasizes the particular aspect of objects, but in *conception, definition, judgment, reasoning* and *systematization* the mind emphasizes the universal aspects of objects.

In conception the mind selects a number of the common attributes of a class of objects and forms an idea from them. Thus one's idea, *triangle,* is made up of (1) the idea, polygon; (2) having just three sides and angles. These are attributes common to all triangles. The mind's process of forming such general ideas is conception. Thus the following definition for it:

Conception is the mind's process of forming an idea made up of the common attributes of a class of objects.

Conception's advance in development over imagination, memory and sense-perception is in shifting the mind's emphasis from the particular aspects of objects to the general aspects. Sense-perception and imagination, the idea-forming stages of knowing below conception, give the mind particular ideas; conception, also an idea-forming stage of knowing, advances to the general idea.

Definition.—An examination of how the mind naturally forms a definition will reveal the nature of the process of definition.

Let the thing to be defined be the triangle. The mind examines a particular triangle, observing its attributes; then it examines a second triangle, observing its attributes; then a third, and so on. The mind compares these various particular triangles and selects their essential common attributes. It finds that a triangle (1) *is a polygon;* (2) *has just three sides,* and (3) *has just three angles.*

The mind now makes a synthesis of these common truths of triangles in the form of a thought, which gives the following: *A triangle is a polygon having just three sides and three angles.* This, it is evident, is a definition of a triangle, and the mind's process of arriving at this mental product is the mental process of *definition.* Hence the following definition:

Definition is the mental process of making a synthesis of the essential common attributes of a class of objects in the form of a thought.

The advance of definition over conception is in that (1) definition is more definite than conception; (2) definition is more economical. The first of these points appears from the fact that we have concepts of many things which we have never defined and can not define. The second appears from the fact that in conception the mind selects as many common attributes as it can, while in definition it selects only the essential ones.

Judgment.—The mind gets particular ideas through sense-perception, and general ideas through conception. In judgement the mind grasps and asserts the relation between ideas. For example, the mind of man had the idea, *coal,* and the idea, *fuel,* for years before it ever grasped the relation between those ideas. When at last it did, it asserted that *coal is a fuel.* This process of grasping the relation between ideas and asserting it is the mind's process of judging. Hence the following definition:

Judgment is the mind's process of grasping the relation between ideas and asserting it.

The advance in development in judgment is asserting the relations between ideas of any kind whatever; that is, in getting more relations, and emphasizing them.

Reasoning.—In judgment the mind emphasizes the relation between ideas. In reasoning it emphasizes the relation among judgments. In every act of reasoning there are three judgments involved, so related that the last is reached because of its relation to the other two. Thus having the two judgments, *Man is mortal, and William is a man,* the mind reaches the third judgment,

William is mortal, and this process of the mind is reasoning. Hence the definition:

Reasoning is the mind's process of reaching a judgment because of its relation to two preceding judgments.

The advance in development in reasoning is in *grasping the relation between entire judgments,* a further broadening of the relations grasped.

Systematization.—In judgment the mind grasps the relation between ideas; in reasoning, between judgments; and in systematization, between complete acts of reasoning. Thus by systematization the mind connects all the truths of plant life into a complete system—the science of botany; also, all the truths of animal life into the science of zoology. Thus the definition:

Systematization is the mind's process of grasping the relations between complete acts of reasoning.

It is evident that in systematization the mind reaches broader relations than in reasoning and this is its advance over reasoning. Science and philosophy result from systematization.

Intuition.—Intuition, the highest stage in the development of knowing, is *rational insight.*

In the stages in the development of knowing from *sense-perception* to *imagination,* inclusive, the mind emphasizes the particular aspects of known objects; but in the development of knowing from *conception* to systematization, inclusive, the mind emphasizes the general aspects of objects. Thus in no stage of knowing from sense-perception to systematization does the mind grasp an object with equal emphasis upon both its particular and general aspects. This it does in the highest stage

of knowing, *Intuition.* Intuition in its fullness is thus knowing an object completely, and is thus the end of the development of knowing. This knowing is always more or less implicit; that is, not reflectively in consciousness. Hence the definition:

Intuition is the mind's process of implicitly grasping an object with equal emphasis upon both its particular and general aspects.

In intuition the advance is in the *equal emphasis of the mind* in grasping an object in both its general and particular aspects. This is the most complete knowing of an object and with it the development of knowing ends.